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AN INVESTIGATION OF THE MEDICAL AND SOCIAL NEEDS OF PATIENTS IN MENTAL HOSPITALS

I. CLASSIFICATION OF PATIENTS ACCORDING TO THE TYPE OF INSTITUTION REQUIRED FOR THEIR CARE

BY

F. N. GARRATT, C. R. LOWE, AND THOMAS McKEOWN

From the Department of Social Medicine, University of Birmingham

It is well recognized that almost without exception existing mental hospitals are unsatisfactory in size, design, and possibly also in site, but it is by no means obvious what type of hospitals should replace them. Are they to be large institutions equipped to deal with mental patients of all classes, or small specialized units catering for restricted groups? Should they be relatively isolated, as in the past, or associated closely with the general hospital system? To what extent should the functions of the mental hospitals be taken over by the general hospitals? Some kind of answer must be given to these and related questions if institutional care for the mentally sick is to be planned intelligently.

A recent Report of the Ministry of Health (1956a) discusses the future planning of hospital services for the mentally sick, and suggests that it is necessary to "review certain fundamental considerations on which past planning of mental hospitals has been based". The Report recognizes the varying requirements of the present population of mental hospitals, and the desirability of reconsidering the nature and site of the accommodation. This cannot be done, however, without much fuller information than is yet available about the population now in mental institutions. What is required is a classification of patients according to their medical, nursing, and social needs, with, where it is relevant, an assessment of domestic circumstances. With this knowledge it should be possible to suggest the type, size, and possibly also the site of the accommodation which should be provided. The purpose of the present inquiry was to obtain the requisite data by an assessment of a sufficiently large and representative group of patients in mental hospitals. It follows two other investigations based on patients in the Birmingham area: the first examined some of the problems of providing care and treatment for the mental hospital population of the Birmingham region (Cross, 1954); the second considered in detail the circumstances of long-stay patients in one hospital (Cross, Harrington, and Mayer-Gross, 1957).

METHODS

It was considered that the inquiry might be concerned with mental patients (*a*) in the Midland Region, or (*b*) in the City of Birmingham, or (*c*) in a single hospital. The first possibility could have been attempted only by the use of some sampling procedure which would have been complicated and would have created administrative difficulties; and the last would have been open to criticism on the grounds of the possible unrepresentativeness of any one hospital. It was therefore thought preferable to try to include all mentally sick persons in hospital* who were Birmingham residents. Since nearly all Birmingham mental patients go to Birmingham hospitals it would be unnecessary to visit institutions outside the city. And at institutions within the City it would be relatively easy to exclude non-residents. The City population had the further advantage that it could be related (for example in respect of sex and age distribution) to the total Birmingham population, for which information was available from the Census.

Table I (overleaf) gives the distribution between the four Birmingham mental hospitals (*a*) of all patients (4,278), and (*b*) of those patients (3,555) who were Birmingham residents. A further small number of mentally-ill patients (seventeen at the time of the survey) were in the Teaching Hospitals which

* Patients in mental deficiency institutions are excluded.

operate a large out-patient department for treatment of mental illness. These were non-statutory patients, however, and it was thought preferable to exclude them from the analysis of the mental hospital population, which otherwise consists wholly of patients retained under the Lunacy and Mental Treatment Acts.

TABLE I
NUMBERS OF BIRMINGHAM PATIENTS IN MENTAL HOSPITALS, JANUARY TO MARCH, 1957

Hospital	Total Number of Patients	Number of Birmingham Residents		
		Males	Females	Total
A	1,352	462	738	1,200
B	1,222	354	592	946
C	952	314	579	893
D	752	229	287	516
Total	4,278	1,359	2,196	3,555

At the outset it was clear that most of the data required were not contained in any existing documents which hospitals keep for medical or administrative purposes. Nor was it considered practical to modify hospital records so that the information could be returned with the routine statistics. What was evidently needed was an *ad hoc* inquiry, designed for a specific purpose and conducted for a limited period.

It was thought necessary to put the main burden of this inquiry on a research staff provided from the university, rather than on the medical staff of the hospitals. There were two obvious objections to the employment of the hospital staff. In the first place the labour involved was very considerable and it seemed unlikely that the regular staff would have been able to undertake it. Secondly, the satisfactory completion of the records required a greater knowledge of the object and methods of the investigation than it seemed reasonable to expect of a large number of hospital doctors. At the same time it was obvious that the data could not be obtained without the assistance of someone who had intimate knowledge of the patients. The records were therefore completed by three full-time doctors from the university advised by the psychiatrist in charge of each case.

In the period January 1–March 31, 1957, a record card was completed for each of the 3,555 Birmingham mental patients. The cards were so designed that the data could be transferred readily to punch cards if necessary, although they were not in fact transferred and the original records were sorted by hand. Two considerations influenced this decision: mechanical equipment was not available within the university department, although it could have been used without serious inconvenience elsewhere; and, more important, the material was such that there were obvious advantages in hand sorting. The number of records to be handled was admittedly rather high for this purpose, perhaps near the limit above which it would have been impractical to sort by hand.

Perhaps the chief point of interest in the design of the card is that after the entry of material required for all patients (name, address, sex, age, duration of stay, diagnosis, mobility, continence, etc.), each individual was assigned to one of three classes according to the facilities required for his care.

Full Hospital Facilities.—Patients who required hospital investigation or treatment (*x*-rays; laboratory examinations; surgery; skilled nursing, etc.) for mental or physical illness.

Limited Hospital Facilities.—Patients who did not require hospital investigation or treatment, but needed basic nursing for mental or physical illness, or supervision because of their mental state.

No Hospital Facilities.—Patients who did not require nursing or mental supervision and needed only accommodation and occupational facilities.

This classification was suggested by earlier experience of an investigation of the chronic sick in hospital (Lowe and McKeown, 1949) and by a preliminary inspection of fifty patients in two wards of one of the mental hospitals. With the help of the psychiatrist in charge it was found possible at an early stage in the completion of the document to place a patient in one of the three classes. This classification had the great advantage that, once it had been made, a different card could be completed in respect of each class. The questions which are of interest are quite different according to the type of patient: contrast, for example, the information required about a mental patient with acute physical illness needing hospital treatment, with that needed for one who could be discharged if he had a suitable home, and who requires only hostel accommodation and suitable employment. To record such widely different types of information on a common document is wasteful of space and labour, and, what is more serious, extremely confusing. An early classification made it possible to relate questions much more closely to the circumstances of the individual under consideration.

TABLE II

DISTRIBUTION OF PATIENTS IN MENTAL HOSPITALS ACCORDING TO AGE

Age (yrs)		16–24		25–34		35–44		45–54		55–64		65–74		75 and Over		All Ages	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Birmingham Survey	Males	30	2·2	154	11·3	246	18·1	301	22·1	289	21·3	211	15·5	128	9·4	1,359	100
	Females	31	1·4	122	5·6	252	11·5	365	16·6	432	19·7	484	22·0	510	23·2	2,196	100
	All Patients	61	1·7	276	7·8	498	14·0	666	18·7	721	20·3	695	19·6	638	17·9	3,555	100
All Patients in Mental Hospitals of E. and W., 1954*		3,426	2·3	14,748	10·0	21,721	14·7	30,709	20·8	31,738	21·5	28,054	19·0	17,333	11·7	147,729	100

* Royal Commission on the Law Relating to Mental Illness, etc. (1957).

REPRESENTATIVENESS OF THE BIRMINGHAM MENTAL HOSPITAL POPULATION

Although there is considerable variation in the composition of the populations of individual hospitals, it seemed probable that the 3,555 Birmingham patients, drawn from a general population of over one million, would be reasonably representative of the mental hospital population of England and Wales (145,457 in 1955*), of which they represented approximately one in forty (2·4 per cent.). We have compared the Birmingham and the national mental hospital populations in respect of (*a*) age distribution, (*b*) status under the Lunacy and Mental Treatment Acts, (*c*) duration of stay, and (*d*) degree of overcrowding. The only notable differences between the two populations are:

(*a*) Mental hospital patients were a little older in Birmingham than in the country as a whole (Table II).

(*b*) In Birmingham the proportion of voluntary patients was slightly higher, and the proportion of certified patients correspondingly lower (Table III). For the purpose of this comparison we have excluded non-statutory patients.

TABLE III

STATUS OF PATIENTS IN MENTAL HOSPITALS*

Status	Birmingham Survey		England and Wales, 1955†	
	No.	%	No.	%
Voluntary ..	1,082	31·2	38,047	26·2
Temporary ..	—	—	464	0·3
Certified	2,386	68·8	106,946	73·5
Total	3,468	100	145,457	100

* Non-statutory patients and patients detained under sections 20 and 21 of the Lunacy and Mental Treatment Acts are excluded.
† Ministry of Health (1956b).

* Health Service patients only.

(*c*) A slightly higher proportion of Birmingham patients had been in hospital for less than a year (Table IV).

TABLE IV

DISTRIBUTION OF PATIENTS IN MENTAL HOSPITALS ACCORDING TO DURATION OF STAY

Duration of Stay (yrs) ..	Less than 1	1–4	5–9	10–19	20–29	30 and Over	Total
Birmingham Survey ..	20	20	15	22	15	8	100
England and Wales, 1954*	17	22	15	22	14	10	100

* Royal Commission on the Law Relating to Mental Illness, etc. (1957).

(*d*) The degree of overcrowding was a little lower in Birmingham (14·1 per cent.) than in the country as a whole (14·8 per cent.), a difference most marked among male patients (7·9 per cent. and 10·8 per cent. for the two hospital populations respectively).

All these differences are relatively small, and are probably accounted for chiefly by the fact that the period of the survey (1957) is about 2 years later than that for which the most recent national data are available. During this time the trend in mental hospitals has been towards increasing age of patients, and voluntary rather than certified admissions. It seems permissible therefore to regard the Birmingham mental hospital population as being reasonably representative of that of England and Wales.

RESULTS

It was stated above that the primary object of this inquiry was to obtain information about the care required by each patient, and to use this information to classify mental hospital patients according to the

kind of institutional facilities which should be provided. The types of service considered to be most important for this purpose were medical treatment, nursing care, supervision, and occupation; the assessment of the needs of each patient for these services was made by the psychiatrist responsible for his care, and it should be emphasized that it was based on the service which was thought to be desirable rather than on that actually being given at the time of the survey.

Medical Treatment

The percentage distribution of patients according to diagnosis is given in Table V; for this purpose we have used the classification suggested in the 1948 International Statistical Classification.

TABLE V
DIAGNOSIS

Diagnosis*	Males		Females		All Patients	
	No.	%	No.	%	No.	%
Schizophrenia (300)	685	50·4	765	34·8	1,450	40·8
Manic Depressive Reaction (301) ..	103	7·6	200	9·1	303	8·5
Involutional Melancholia (302)	24	1·8	128	5·8	152	4·3
Paranoid State (303)	102	7·5	238	10·8	340	9·6
Senile Psychosis (304)	82	6·0	394	17·9	476	13·4
Other Psychoses (305–09)	88	6·5	131	6·0	219	6·2
Psychoneuroses (310–18)	24	1·8	45	2·0	69	1·9
Disorders of Character and Behaviour (320–24; 326) ..	39	2·9	35	1·6	74	2·1
Mental Defect (325)	76	5·6	126	5·7	202	5·7
Syphilis (025) ..	27	2·0	24	1·1	51	1·4
Epilepsy (353) ..	58	4·3	76	3·5	134	3·8
Other Disorders ..	51	3·8	34	1·5	85	2·4
Total	1,359	100	2,196	100	3,555	100

* Numbers in brackets are the list numbers used in the 1948 International Statistical Classification.

The assessment of medical treatment needed (Table VI) was not based on a theoretical consideration of the demands of different types of illness, but upon a separate appraisal of each patient's needs. The treatment which patients were actually receiving was also noted, and not surprisingly was usually identical with that considered to be desirable. Approximately 13 per cent. of patients required investigation or active medical treatment (E.C.T., intensive administration of tranquillizers, insulin, etc.), and 42 per cent. needed maintenance treatment (regular administration of tranquillizers, anti-convulsant drugs for epilepsy, etc.). The other 45 per cent. were considered to require no medical treatment whatsoever; they made no demands on the hospital laboratory or therapeutic services and did not require a regular visit from a doctor.

TABLE VI
MEDICAL TREATMENT REQUIRED

Medical Treatment Required	Active		Maintenance		None		Total	
	No.	%	No.	%	No.	%	No.	%
Males ..	239	17·6	433	31·9	687	50·5	1,359	100
Females ..	220	10·0	1,072	48·8	904	41·2	2,196	100
All Patients	459	12·9	1,505	42·3	1,591	44·8	3,555	100

It should perhaps be noted that psychiatrists did not always agree about the best treatment of a specific illness, and this was reflected in differences between individual hospitals. These differences of opinion were chiefly in respect of the type of active or maintenance treatment, and did not affect the broad classification shown in Table VI, which did not vary appreciably from one hospital to another.

Nursing Care

In assessing nursing care we have made a broad distinction between skilled and basic nursing. Under skilled nursing is included both general and mental nursing for which a considerable degree of training and experience is required: for example, assistance with investigation, assessment or active treatment, and the care of acutely-ill patients. Under basic nursing is included personal services—washing, dressing, feeding, lifting, attention to bladder and bowel of the incontinent—which do not require the degree of skill or experience referred to above. This distinction between skilled (or technical) and basic nursing was used in the study of the work of nurses published by the Nuffield Provincial Hospitals Trust (1953), and is essentially the same as that employed in an investigation of the needs of the chronic sick (Lowe and McKeown, 1949). We have not included under nursing care the supervision which some patients needed because of their mental state; this is of course the feature which specially distinguishes the care of mental illness from that of physical illness, and it seemed better to assess it separately in the discussion of "supervision" than to confuse it with the requirements for traditional nursing services.

In addition to the requirement of treatment, the two features which have most influence on demands for nursing care are mobility and continence (Tables VII and VIII respectively). More than four-fifths were fully ambulant, and only about one-twelfth were confined to bed. Approximately one in seven were partly or wholly incontinent.

TABLE VII
MOBILITY

Mobility	Bedfast		Sitting Out of Bed		Partly Ambulant		Fully Ambulant		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Males ..	76	5·6	48	3·5	69	5·1	1,166	85·8	1,359	100
Females	213	9·7	84	3·8	96	4·4	1,803	82·1	2,196	100
All Patients..	289	8·1	132	3·7	165	4·6	2,969	83·5	3,555	100

TABLE VIII
CONTINENCE

Continence ..	Incontinent				Continent		Total	
	Wholly		Partly					
	No.	%	No.	%	No.	%	No.	%
Males ..	103	7·6	40	2·9	1,216	89·5	1,359	100
Females ..	325	14·8	39	1·8	1,832	83·4	2,196	100
All Patients ..	428	12·0	79	2·2	3,048	85·7	3,555	100

Table IX gives an analysis of nursing demands. 12·9 per cent. of the patients were considered to require skilled nursing, but—and this distinguishes them from patients in general hospitals who need skilled nursing—as a rule they did not require basic nursing as well. Most of them are patients admitted for investigation and treatment and on this account they require skilled nursing. They are not usually confined to bed, and hence make few demands for the personal services referred to above as basic nursing.

23·2 per cent. of the patients needed basic nursing only, and the remainder (63·9 per cent.) made no demands on the nursing services. In Table IX the last group of patients is subdivided according to whether they needed supervision (51· 5 per cent. of all patients) or not. That is to say that, of the whole population of 3,555 patients, there were 441 (12·4 per cent.) with no requirements for personal services.

SUPERVISION

As stated above it is the need for supervision which distinguishes the care of the mentally sick from that of the rest of the hospital population. For the purposes of assessment the degrees of supervision were defined as follows:

Close Supervision.—Personal supervision of severely disturbed patients. Most patients requiring this degree of supervision were either aggressive (occasionally homicidal) or suicidal.

Limited Supervision.—Supervision of patients who, although they did not require close supervision, could not be allowed full freedom within the hospital community. Most patients in this group were suffering from the milder forms of disturbed behaviour which made it desirable to keep them in a sheltered environment.

Open Supervision.—Confinement to the mental hospital with complete freedom of movement within it. Patients so classified were considered to be capable of looking after themselves within the restricted environment of the hospital, although they were not suitable to be released in the general community.

No Supervision.—Patients were said to require no supervision if in the opinion of the psychiatrist they were capable of living outside the hospital. either in a hostel or at home.

In practice, patients in the first and last of these four classes (close supervision and no supervision)

TABLE IX
NURSING CARE REQUIRED

Nursing Required ..	Skilled				Basic Only		None				Total	
	Only		With Basic Nursing				With Supervision		Without Supervision			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Males	185	13·6	54	4·0	260	19·1	684	50·3	176	13·0	1,359	100
Females	157	7·1	63	2·9	564	25·7	1,147	52·2	265	12·1	2,196	100
All Patients	342	9·6	117	3·3	824	23·2	1,831	51·5	441	12·4	3,555	100

were easily identified. The remainder were not so readily divided according to whether they needed limited or open supervision. The distinction was influenced to some extent by the design of the buildings within a given hospital, by the choice of treatment, particularly the frequency of use of tranquillizers, and by the readiness of the medical and nursing staffs to re-examine traditional views about the supervision required by the mentally ill. These influences no doubt largely explain the variations in the estimates of supervision required in different hospitals (Table X).

The data for all four hospitals are brought together in Table XI. Of the whole population of the mental hospitals, only 1·2 per cent. needed close supervision; most of these patients were receiving intensive treatment, usually convulsive therapy or massive doses of tranquillizers. About two-fifths (42·6 per cent.) required limited supervision, and the rest were either free within the hospital community (41·9 per cent.). or needed no supervision at all (14·3 per cent.).

Occupation

Because of the prolonged period which mentally-ill patients have to spend in hospital, as well as the contribution it may make to their recovery, occupation is a more significant feature of the care of mental than of physical illness. In some respects it is the most difficult requirement to assess, but we have attempted to classify the type of work which patients could, and usually for their own welfare should do, as follows:

Productive Work.—Any work which would have to be done whether or not patients were available for it. The productive work which the patients did was almost entirely in the wards, kitchens, canteen, sewing room, or laundry, or in the gardens or hospital farms; only ten were employed in productive work outside the hospital community and it seemed somewhat theoretical to attempt to assess the proportion who could have been so employed. The distinguishing feature of productive work as defined above is that it makes a worthwhile contribution to the community, and is not merely an exercise undertaken on behalf of the patient.

Occupational Therapy.—This term scarcely needs definition; it refers to the usual creative, but essentially unproductive work, introduced in order to occupy the patient and arouse his interest. It was usually done in specially equipped rooms, but occasionally, in the case of patients restricted to the ward or confined to bed, in the wards.

Light Work in Ward.—This includes small tasks, such as dusting and polishing, given in an attempt to interest the patient, which make little or no contribution to the work of the wards. In general, the patients so occupied were not considered suitable or ready to benefit from occupational therapy.

TABLE X

VARIATION IN ASSESSMENT OF SUPERVISION REQUIRED

Supervision Required	Close		Limited		Open		None		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Hospital A	22	1·8	265	22·1	731	60·9	182	15·2	1,200	100
Hospital B	15	1·6	579	61·2	137	14·5	215	22·7	946	100
Hospital C	5	0·6	493	55·2	331	37·0	64	7·2	893	100
Hospital D ..	2	0·4	176	34·1	291	56·4	47	9·1	516	100
All Hospitals ..	44	1·2	1,513	42·6	1,490	41·9	508	14·3	3,555	100

TABLE XI

SUPERVISION REQUIRED

Supervision Required	Close		Limited		Open		None		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Males	13	1·0	546	40·2	600	44·1	200	14·7	1,359	100
Females	31	1·4	967	44·0	890	40·5	308	14·0	2,196	100
All Patients ..	44	1·2	1,513	42·6	1,490	41·9	508	14·3	3,555	100

TABLE XII
OCCUPATION REQUIRED

Occupation Required	None		Light Work in Ward		Occupational Therapy		Productive Work		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Males	407	29·9	195	14·3	361	26·6	396	29·1	1,359	100
Females	741	33·7	170	7·7	787	35·8	498	22·7	2,196	100
All Patients ..	1,148	32·3	365	10·3	1,148	32·3	894	25·1	3,555	100

Table XII shows the distribution of patients according to the occupation needed. Approximately one-third (32·3 per cent.) were considered to be incapable of any work, either because they were acutely ill, or because of their mental state. The proportions fit for light work in the wards or for occupational therapy were one-tenth and one-third respectively. The remaining one-quarter of the patients were able to do productive work. It should be emphasized that, in many cases, patients were not doing the work which was considered suitable. Most of those ready for productive employment were so engaged, but the proportion having occupational therapy (20 per cent.) was much below the estimate (32·3 per cent.) of those who might be expected to benefit from it. This difference reflects, of course, the limited resources of the hospitals. Many of these patients who were ready for but were not receiving occupational therapy were doing light work in the wards, but some of them were wholly unemployed.

CLASSIFICATION OF PATIENTS ACCORDING TO HOSPITAL FACILITIES REQUIRED

Psychiatrists were asked to classify patients according to whether their care required full hospital facilities, limited hospital facilities, or no hospital facilities. The nature of the needs which were considered to justify assigning a patient to each class was given in the discussion of "methods". Broadly what was attempted was to separate patients needing the full resources of a modern hospital from those who needed only basic nursing or supervision and from those who did not need hospital care. Although this assessment was first made at an early stage of the completion of the form for each patient—in order to facilitate the recording of different information for each class—the classification was not finally accepted until after completion of the whole document. In a few cases it was necessary, with the psychiatrist's agreement, to re-classify a patient, but in general, particularly when they were familiar with the objects and methods of the inquiry, their original judgement of the appropriate class proved acceptable.

Table XIII gives the results of the assessment. 12·9 per cent. of the patients were considered to require full hospital care, and the proportion is considerably higher for males than for females. About three-quarters (74·7 per cent.) needed limited hospital facilities, that is the simple nursing or personal supervision referred to above. The remainder (12·4 per cent.) were thought not to require any of the services traditionally associated with hospitals, and many of them could have been discharged if they had had a suitable home.

TABLE XIII
CLASSIFICATION OF PATIENTS ACCORDING TO HOSPITAL FACILITIES REQUIRED

Hospital Facilities Required ..	Full		Limited		None		Total	
	No.	%	No.	%	No.	%	No.	%
Males ..	239	17·6	944	69·5	176	13·0	1,359	100
Females ..	220	10·0	1,711	77·9	265	12·1	2,196	100
All Patients ..	459	12·9	2,655	74·7	441	12·4	3,555	100

DISCUSSION

This communication is the first of a series which will present the results of an investigation of all Birmingham patients in mental hospitals. The purpose of the investigation was to assess the needs of patients, with a view to providing information which might assist in planning the future mental hospital services. The first report examines the care required, and the data are used to classify patients into three groups according to whether they needed full hospital facilities, limited hospital facilities, or no hospital facilities. The subsequent reports will consider the patients assigned to each of these groups.

The features of care which were considered to be most important from the point of view of the facilities required were medical treatment, nursing, supervision, and occupation, and the results are presented in Tables VI, IX, XI, and XII respectively. In the case of the first three items almost all patients

were already having the care they were thought to need; this is scarcely surprising, since psychiatrists are unlikely to permit any serious deficiency of the medical or nursing care or supervision of their patients. There were, nevertheless, considerable differences of opinion between psychiatrists, reflected in the results for the four Birmingham mental hospitals, both about the treatment of choice for a specific form of mental illness, and about the amount of supervision which patients required. This again is not unexpected, since views about treatment and supervision are changing fairly rapidly at the present time. It is in respect of occupation, however, that there was the most obvious difference between what the patients were doing and what it was thought they should be doing. This difference was evident from the considerable number of patients who might have benefited from occupational therapy, although they were doing only light work in the wards or no work at all.

In a later report we shall discuss more fully the possible significance of the results of assessment of patients' needs in relation to the future planning of mental hospitals. Here we are concerned only with the separation of patients into three broad classes according to their need for full, limited, or no hospital facilities (Table XIII). For the purposes of planning this seems to us the most fundamental division. Whatever their site, probably no one would question that the buildings and facilities appropriate to the needs of each of these groups are entirely different. Patients in the first class require the full resources of a modern hospital, and because they are under intensive investigation or treatment their occupation in most cases is a secondary consideration. Patients in the second class also need services—simple nursing and supervision—traditionally associated with hospitals, but because they do not require intensive investigation, treatment, or skilled nursing they can be catered for without loss of efficiency and much more economically if housed in a separate and altogether simpler unit. Because the great majority of these patients are ambulant, the design of such a unit should be quite different from that of one intended for the chronic sick, who also do not need full hospital facilities but, being confined to bed, need a much higher ratio of ward to day-room and other facilities. Mental patients in this class are also distinguished from those in the first class by the greater significance of their occupation. For patients in the third class, the facilities needed are not those traditionally associated with hospitals; they require only to be in a hostel or home where they can be given adequate opportunities for productive work.

It should of course be said that there can be nothing final about the classification which we have proposed. Inevitably the needs of patients reflect in a considerable degree the care which they have received in the past, and there are at least two grounds for expecting both that the incidence of admissions to mental hospitals will fall, and that the relative proportions of institutional patients requiring full, limited, or no hospital care may change. The first reason for optimism is that it seems probable that improved out-patient and home care can considerably relieve the burden on hospitals. It is reported that in Amsterdam the number of hospital admissions has been considerably reduced by careful assessment of patients seeking admission, and by relatively simple social adjustments at home (Querido, 1956). The results should be even better when home medical services for mental illness are linked with the social services as at Nottingham (Macmillan, 1956) and at Oldham (Ministry of Health, 1956a). The second reason for expecting some improvement is that medical treatment is becoming available for some forms of mental illness which formerly were untreated.

These considerations do not affect the usefulness of a classification of patients according to their needs. They merely stress the fact that any classification must be tentative, and the desirability of planning mental hospitals in the light of the most up-to-date information which can be obtained. Facilities based upon an assessment of requirements in the mid-20th century are less likely to become redundant, and will be more readily adapted to other purposes when they do, than facilities designed according to an earlier and outmoded conception of the mental hospital.

Summary

(1) During the period January 1–March 31, 1957, the care required by each of the 3,555 Birmingham residents in mental hospitals was assessed by the psychiatrists responsible for their treatment.

(2) Approximately 13 per cent. of the patients required investigation or active medical treatment, 42 per cent. needed maintenance treatment, and 45 per cent. were considered to require no medical treatment (Table VI).

(3) Skilled nursing was needed by 13 per cent. of the patients and basic nursing (washing, feeding, lifting, dressing etc.) by 23 per cent. The remaining 64 per cent. made no demands on the nursing services (Table IX). These relatively low demands were largely determined by the high proportion of

patients who were fully ambulant (four-fifths) and the relatively low proportion who were incontinent (one-seventh).

(4) Only 1 per cent. of the patients needed close personal supervision because of their mental state (Table XI). Approximately 43 per cent. required limited supervision (in the wards) and the remainder were either free within the hospital community (42 per cent.) or needed no supervision at all (14 per cent.).

(5) About one-third of the patients were considered to be incapable of any work, either because they were acutely ill or because of their mental state (Table XII). The proportions fit for light work in the wards or for occupational therapy were one-tenth and one-third respectively. The remaining quarter of the patients were able to do productive work.

(6) The data were used to classify patients according to the type of facilities required for their care (Table XIII); 13 per cent. were considered to need the full resources of a hospital and 75 per cent. to need limited hospital facilities (essentially simple nursing or personal supervision). The remaining 12 per cent. were thought not to require any of the services traditionally associated with hospitals and many of them could have been discharged if they had had a suitable home.

We are indebted to the Medical Superintendents (Drs. J. J. O'Reilly, I. A. Macdonald, C. E. Roachsmith, and C. M. Ross) and staffs of the four Birmingham mental hospitals for their full co-operation in assessing the needs of their patients, and to the Birmingham Regional Hospital Board for a generous contribution towards the expenses of this inquiry. We are also grateful to Drs. F. C. Edwards and R. H. Cawley for helping to complete the record cards.

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A STUDY OF 137 CASES OF ANENCEPHALY

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In a survey of congenital defects in Dublin (Coffey and Jessop, 1955), it was noted that the predominant abnormality was anencephaly, which accounted for 29·5 per cent. of all major abnormal births. It also appeared that there were certain peculiarities regarding the distribution of this abnormality in the city. It was felt, therefore, that a more detailed inquiry into this condition would be of interest.

The present report is based on births which occurred between March 1, 1953, and April 30, 1955, in the three Dublin Maternity Hospitals (the Rotunda Hospital, the National Maternity Hospital, and the Coombe Hospital) which deal with 80 per cent. of the births in Dublin and the neighbourhood. In the period March 1, 1953, to May 1, 1954, the cases were those already included in the general survey of congenital defects. In the period May 1, 1954, to April 30, 1955, the cases were solely those obtained in the anencephaly study.

METHODS

The occurrence of a case of anencephaly was notified to the authors, usually within 24 hours of the birth. The mother was interviewed as soon as possible after this, using the same questionnaire as that employed in the previous survey.

At the time of the interview, the mother knew that the baby was dead but did not usually know the cause of death, and in completing the questionnaire no information was given to her about the baby's condition. It was felt that if she knew that the baby had been abnormal she might make a special effort to recall instances of other abnormal births in her family, and that consequently an error might be introduced in comparing the information given by her with that obtained for the controls.

A control group of 192 normal cases was taken at random from the same hospitals. When the mother of the abnormal baby had been interviewed, the Ward Sister was asked to indicate the mother in the same puerperal ward who had been delivered of the next normal (but not necessarily live born) baby, and this mother was then questioned. All the normal births included in the initial study of congenital deformities were retained, so that the control group is larger than the anencephaly group.

When the abnormal baby had been born prematurely, the mother was sometimes well enough to be discharged within 48 hours of delivery and before she had been interviewed. In such cases the author who visited the hospital obtained the available details from the hospital records and interviewed the mother of the control.

Haemoglobin was estimated by the acid haematin method, the "normal" being taken as 14·0 g. per 100 ml. Serum protein was estimated by the specific gravity method described by Phillips, Van Slyke, Dole, Emerson, Hamilton, and Archibald (1943). The Wasserman reaction was examined in every case.

RESULTS

INCIDENCE.—The total number of births recorded in the three Maternity Hospitals during the period March 1, 1953, to April 30, 1955, was 23,085. The distribution and incidence of anencephalics is shown in Table I.

TABLE I

INCIDENCE OF ANENCEPHALY IN DUBLIN MATERNITY HOSPITALS, 1953–55

Hospital	Total Births	Anencephalic Births	Incidence (per 1,000)
Rotunda	8,978	42	4·7
National Maternity ..	9,436	55	5·9
Coombe	4,671	40	8·6
Total	23,085	137	5·9

Difference between incidence in (a) Rotunda and National Maternity Hospitals taken together, and (b) Coombe Hospital = 2·64 × standard error (0·125); $P < 0·008$.

The figures support our earlier observations that the incidence is higher in Dublin than any so far reported from other centres, and that it is higher in one hospital (the Coombe) than in either of the other two.

SEX, CONDITION, AND STATE OF DEVELOPMENT OF FOETUS AND DURATION OF PREGNANCY.—In one case the sex was not recorded. There were 26 males and 110 females in the remaining 136, a ratio of 1 : 4·2.

Only 31 infants (22·6 per cent.) were born alive. Of the remainder some had clearly died at or shortly before birth and some had been dead long enough to show varying degrees of maceration. A number of foetuses which did not show obvious maceration were thought to have died perhaps a week or 10 days before delivery. The distribution of the cases according to the condition at birth and the state of development is shown in Table II. In order to allow for the weight of the brain, 10 per cent. was added to the observed weight of the foetus. Only fourteen foetuses (11·1 per cent.) weighed 2,500 g., the weight conventionally accepted as indicating maturity. The preponderence of females is less marked in this group, (nine females to five males) and it is entirely absent in those born alive or recently dead which weighed 2,000 g. and over.

TABLE II

SEX, CONDITION, AND STATE OF DEVELOPMENT OF ANENCEPHALICS

Weight* (g.)	Number Born Alive or recently Dead		Number Macerated or Otherwise presumed Dead for Some Time Before Birth		Total
	Male	Female	Male	Female	
Under 1,250 ..	2	8	5	19	34
1,250–1,999 ..	1	19	6	28	54
2,000–2,499 ..	3	2	1	18	24
2,500 and Over	4	5	1	4	14
Total ..	10	34	13	69	126
Not Recorded					11

*10 per cent. of the observed weight has been added to allow for the weight of the brain.

Duration of pregnancy (reckoned from the date of onset of the last menstrual period) is shown in Table III. Fifty-two (38·2 per cent.) could be regarded as mature if a gestation of at least 37 weeks is accepted as the criterion of maturity. The preponderance of females is least in the most mature groups of those born alive or only recently dead, the male : female ratio being 5 : 8 at 40 weeks and over.

TABLE III

DISTRIBUTION OF ANENCEPHALICS ACCORDING TO DURATION OF PREGNANCY

Duration of Pregnancy (wks)	Number Born Alive or recently Dead		Number Macerated or Otherwise presumed Dead for Some Time before Birth		Total
	Male	Female	Male	Female	
Under 28 ..	–	4	1	10	15
29–36	6	16	10	37	69
37–39	1	7	1	13	22
40 and Over ..	5	8	2	15	30
Total ..	12	35	14	75	136
Not Recorded					1

Two of the anencephalics were twins and in each case the other twin was normal. One pair consisted of two males and the other of an anencephalic male and a normal female.

OTHER CONGENITAL ABNORMALITIES.—Twelve of the 137 anencephalics had an associated defect of the central nervous system, ten of them being cases of spina bifida and two of meningocoele. There were also four cases of exomphalus and two of talipes. During the earlier part of the study, such particulars were sometimes obtained from the clinical notes rather than from direct examination of the foetus and it is possible that some associated deformities were not recorded.

AGE AND CIVIL STATUS OF MOTHER.—The difference between the age distribution of the mothers who gave birth to anencephalic children and that of the controls is shown in Table IV.

TABLE IV

INCIDENCE OF ANENCEPHALICS ACCORDING TO MATERNAL AGE

Maternal Age (yrs)	Affected		Controls		Ratio of Percentage of Affected to Controls
	No.	Per cent.	No.	Per cent.	
Under 20 ..	3	2·2	8	4·2	0·52
20–24 ..	17	12·4	37	19·4	0·64
25–29 ..	27	19·7	70	36·6	0·54
30–34 ..	44	32·1	38	19·9	1·61
35–39 ..	33	24·1	26	13·6	1·77
40–44 ..	13	9·5	11	5·7	1·67
45 and Over	—	—	1	0·6	—
Total ..	137		191*		

*One not recorded

$\chi^2 = 22{\cdot}2$ for $n = 5$; $P < 0{\cdot}005$

The incidence of anencephalic births is significantly higher in mothers over 30 years of age.

Two (2·2 per cent.) of the mothers of anencephalics were unmarried as compared with five (2·6 per cent.) of the mothers of controls.

PARITY.—The distribution of affected foetuses and controls according to parity is indicated in Table V.

TABLE V

INCIDENCE OF ANENCEPHALICS ACCORDING TO PARITY

Parity	Affected		Controls		Ratio of Percentage of Affected to Controls
	No.	Per cent.	No.	Per cent.	
1	31	22·6	55	28·6	0·79
2	17	12·4	47	24·5	0·51
3	23	16·8	24	12·5	1·34
4	17	12·4	25	13·0	0·95
5	12	8·8	13	6·8	1·29
6	13	9·5	8	4·2	2·26
7	12	8·8	3	1·6	1·68
8	—	—	5	2·6	
9	3	2·2	4	2·1	
10 and Over	9	6·5	8	4·1	
Total ..	137		192		

$\chi^2 = 15{\cdot}3$ for $n = 6$; $P < 0{\cdot}025$

Of the mothers who gave birth to anencephalic children 22·6 per cent. were primiparae as compared with 28·6 per cent. of the mothers of controls. This difference is of doubtful significance. When age is taken into account (Tables VI and VII), the association of anencephaly with multiparity is not significant.

TABLE VI

DISTRIBUTION OF ANENCEPHALICS ACCORDING TO MATERNAL AGE AND PARITY

Parity	Maternal Age (yrs)						Total
	Under 20	20–24	25–29	30–34	35–39	40–44	
1	3	8	12	7	1	–	31
2	–	5	6	4	2	–	17
3	–	4	4	7	4	4	23
4	–	–	2	4	8	3	17
5	–	–	1	6	4	1	12
6	–	–	2	6	4	1	13
7	–	–	–	7	4	1	12
8	–	–	–	–	–	–	–
9	–	–	–	2	1	–	3
10 and Over	–	–	–	1	5	3	9
Total	3	17	27	44	33	13	137

TABLE VII

INCIDENCE OF ANENCEPHALICS ACCORDING TO PARITY WITH ADJUSTMENT FOR MATERNAL AGE

Parity	No. Affected		No. of Controls
	Actual	Adjusted for Effect of Age*	
1	31	45·5	55
2	17	22·6	47
3	23	22·8	24
4	17	12·7	25
5	12	8·6	13
6	13	10·4	8
7 and Over	24	14·4	20

$\chi^2 = 6{\cdot}60$ for $n = 6$; $P = 0{\cdot}50$

* Parity distribution in this column calculated by using the age-parity relationship in Table II and taking the age distribution of the controls as a standard.

RELATION OF ANENCEPHALY TO BLOOD GROUP OF MOTHER.—The distribution of mothers according to blood groups is shown in Table VIII.

TABLE VIII

INCIDENCE OF ANENCEPHALICS ACCORDING TO BLOOD GROUP OF MOTHER

Maternal Blood Group	Mothers of Affected		Mothers of Controls	
	Number	Per cent.	Number	Per cent.
O	78	67·8	105	55·0
A	33	28·7	56	29·3
B	4	3·5	26	13·6
AB	–	0·0	4	2·1
Total	115	100	191	100
Not Recorded	22		1	

When Groups B and AB are taken together
$\chi^2 = 11{\cdot}7$ for $n = 2$; $P < 0{\cdot}005$

68 per cent. of the 115 mothers of anencephalics whose blood was tested belonged to Group O. This is significantly higher than the figure for the mothers of controls (55 per cent.), which approximates closely to the estimate of 54 per cent. made by Dawson (1952) for the whole Dublin population. Of the seven mothers to whom a previous anencephalic infant had been born, five were members of Group O. We have no data on the blood group of either the father or the foetus.

NUTRITIONAL STATE OF THE MOTHER.—This was assessed clinically and by estimating the haemoglobin and plasma protein. (Tables IX and X, and Table XI, opposite.)

TABLE IX

INCIDENCE OF ANENCEPHALICS ACCORDING TO NUTRITIONAL STATE OF MOTHERS

Clinical Assessment of Mother's Nutritional State	Mothers of Affected		Mothers of Controls	
	Number	Per cent.	Number	Per cent.
Good	61	58·1	123	64·1
Fair	36	34·3	59	30·7
Poor	8	7·6	10	5·2
Total	105	100	192	100
Not Recorded ..	32			

$\chi^2 = 1{\cdot}30$ for $n = 2$; $P < 0{\cdot}55$

TABLE X

INCIDENCE OF ANENCEPHALICS ACCORDING TO MATERNAL HAEMOGLOBIN

Haemoglobin (per cent.)	Mothers of Affected		Mothers of Controls	
	Number	Per cent.	Number	Per cent.
Under 70	38	35·5	47	24·5
70 and Over ..	69	64·5	145	75·5
Total	107	100	192	100
Not Recorded ..	30			

$\chi^2 = 4{\cdot}11$ for $n = 1$; $P < 0{\cdot}05$

TABLE XI

INCIDENCE OF ANENCEPHALICS ACCORDING TO MATERNAL PLASMA PROTEIN

Plasma Protein (g. per 100 ml.)	Mothers of Affected		Mothers of Controls	
	Number	Per cent.	Number	Per cent.
Under 5·5	42	43·8	54	28·4
5·5 and Over ..	54	56·2	136	71·6
Total	96	100	190	100
Not Recorded ..	41		2	

$\chi^2 = 6{\cdot}72$ for $n = 1$; $P < 0{\cdot}01$

The levels of haemoglobin and plasma protein show significant differences between the mothers of anencephalics and the mothers of controls. The clinical assessment shows a similar trend, but the difference is not significant.

VOMITING DURING PREGNANCY.—The incidence of excessive vomiting was more than three times as frequent in the mothers of anencephalics as in the mothers of controls (Table XII).

TABLE XII

FREQUENCY OF VOMITING DURING PREGNANCY

History of Vomiting	Mothers of Affected		Mothers of Controls	
	Number	Per cent.	Number	Per cent.
Nil	39	37·5	96	50·0
"Normal"	34	32·7	79	41·1
Excessive	31	29·8	17	8·9
Total	104	100	192	100
Not Recorded ..	33			

There is no significant difference between the two groups in the frequency of vomiting during the earlier months, but there is a marked difference in the later months (Table XIII).

TABLE XIII

TIME OF ONSET OF EXCESSIVE VOMITING DURING PREGNANCY

Time of Onset of Excessive Vomiting	Number of Mothers of	
	Affected	Controls
Up to 3rd Month	12	12
3rd, 4th, and 5th Months ..	7	1
6th Month and Later	12*	4

*Two cases had vomiting in both early and later pregnancy

This suggests either that the vomiting was the result rather than the cause of the abnormality, or that both abnormality and vomiting were due to some common factor. In about one-third of the cases of severe vomiting after the third month the disturbance lasted less than four weeks. Information was not obtained about the occurrence of vomiting in previous pregnancies.

ILLNESSES DURING PREGNANCY.—Each mother was questioned carefully about her general health during pregnancy, particular attention being paid to virus infections, including "influenza". Since laboratory confirmation was not available this latter term was used in the popular sense and probably embraced a number of types of severe upper respiratory tract infections.

A high proportion (about 80 per cent.) of the mothers had had no illness during pregnancy and this proportion was almost the same in the mothers of anencephalics and in mothers of controls. The Wasserman reaction was negative in all cases. Amongst the mothers who had suffered from illnesses, the incidence was the same in both groups, approximately one illness per mother. However, in the mothers of anencephalics, the illnesses had occurred predominantly in the first 3 months, while in the control group they had occurred generally at a later period. Of 28 mothers who gave a history of illness during the first 3 months of pregnancy, 21 were mothers of anencephalics and seven were mothers of controls. No mother gave a history of rubella during pregnancy.

PREVIOUS CONGENITAL ABNORMALITIES.—There were 98 multiparae in the anencephalic series who were interrogated, of whom 26 had previously given birth to a congenitally abnormal baby, seven of them to an anencephalic foetus. In one of the latter the present pregnancy had been the seventh and the mother had had two previous anencephalics, her fourth and sixth babies. Her other four children were normal. The control series contained 137 multiparae, nine of whom had had a malformed child. None of the mothers of controls had ever given birth to an anencephalic.

PREVIOUS OBSTETRIC HISTORY.—Of the 98 multiparae for whom data were available, 52 per cent. gave a history of miscarriages, abortions, or stillbirths, as compared with 28 per cent. of the mothers of controls. A small part of this difference, and of the difference mentioned in the preceding paragraph, can be explained by the fact that the mothers of anencephalics had had, on the whole, more pregnancies than the mothers of controls.

PREVIOUS MEDICAL HISTORY.—A careful clinical history was taken from each mother, but nothing of any significance was elicited; nor was there any significant difference between mothers of anencephalics and the mothers of controls in the proportion who had a satisfactory level of health.

TABLE XIV

CONGENITAL ABNORMALITIES IN MOTHER'S AND FATHER'S FAMILY

Affected Relative	Mothers				Fathers			
	Of Affected		Of Controls		Of Affected		Of Controls	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
None	86	82·7	184	96·8	96	92·3	180	97·3
Brother or Sister	8	7·7	5	2·6	5	4·8	4	2·2
Father, Mother, Uncle, or Aunt	5	4·8	—	—	1	1·0	1	0·5
Cousin	5	4·8	1	0·5	2	1·9	—	—
Total	104	100	190	100	104	100	185	100
Not Recorded	33		2		33		7	

$\chi^2 = 17·9$ for $n = 1$; $P < 0·005$ $\chi^2 = 3·8$ for $n = 1$; $P = 0·05$

FAMILY HISTORY OF CONGENITAL ABNORMALITIES.—The frequency of a family history of congenital abnormalities on the maternal and paternal sides is indicated in Table XIV. The information was given by the mother and is, therefore, limited to abnormalities that were obvious on inspection.

The proportion in which there was no history of an abnormal relative was smaller in the anencephalic series than in the control series, on both the mother's and the father's side.

Abortions and miscarriages were not included, since it was felt that information was not likely to be reliable. One case, however, was of such interest that a special inquiry was made. The mother was one of a pair of twins which she believed to be identical. Before her present pregnancy she had had two abortions and two abnormal babies, one hydrocephalic and one anencephalic. The present was her fifth pregnancy and had resulted in a second anencephalic. Her twin sister had had four full-term children and three miscarriages about which no further information was available. In twelve pregnancies, these twin sisters had produced three abnormal babies, five abortions or miscarriages, and four normal children.

No case was noted in which the father was one of twins.

RELATION OF ANENCEPHALY TO OCCUPATION OF PARENTS.—The occupation of the parents was used as a rough indication of their social class and possibly of their nutritional state (Tables XV and XVI). The finding of greatest interest is that nearly 10 per cent. of the fathers of anencephalics were unemployed whereas none of the fathers in the control series was out of work. The mothers of the two series show no obvious differences.

TABLE XV

INCIDENCE OF ANENCEPHALICS ACCORDING TO FATHER'S OCCUPATION

Father's Occupation	Fathers of Affected		Fathers of Controls	
	Number	Per cent.	Number	Per cent.
Manual (regular)	81	66·4	133	71·5
Manual (casual)	4	3·3	23	12·4
Non-Manual	25	20·6	30	16·1
Unemployed	12	9·7	—	—
Total	122	100	186	100
Not Recorded	15		6	

TABLE XVI

INCIDENCE OF ANENCEPHALICS ACCORDING TO MOTHER'S OCCUPATION

Mother's Occupation	Mothers of Affected		Mothers of Controls	
	Number	Per cent.	Number	Per cent.
Housewife	18	17·8	29	15·2
Manual	58	57·4	114	59·7
Non-Manual	25	24·8	48	25·1
Total	101	100	191	100
Not Recorded	36		1	

DISCUSSION

The incidence of anencephaly recorded in this survey (5·9 per 1,000) is higher than any so far reported. Previous workers have found incidences per 1,000 varying from 0.64 (Böök and Rayner, 1950) to 3·15 (Malpas, 1937). In our material, the incidence in one hospital reached 8·6.

The preponderance of females has been noted by all the workers who have studied this problem (*e.g.* Malpas, 1937; Angevine, 1938; Penrose, 1946; Record and McKeown, 1949; Böök and Rayner, 1950; Carter, 1950), but no satisfactory explanation has yet been put forward. All workers also agree

that a high proportion of anencephalics are born prematurely. It has been noted that the proportion of males increases with increasing length of gestation (MacMahon and McKeown, 1952) and the same trend can be demonstrated in the data of Böök and Rayner (1950) and in the results of the present investigation.

The findings in this paper agree also with those of other workers in suggesting a familial element in the incidence of anencephaly. Difficulties in interpretation arise from the fact that information is not available at present about the composition of complete families in which an anencephalic birth has occurred. The suggestion of Böök and Rayner (1950) that anencephaly could be caused by a recessive "anencephalic" gene would require an excessively high mutation rate. Neither in our material nor in that reported by others could any definite conclusion be drawn regarding the association with consanguinity.

Of special interest in relation to familial incidence is the occurrence of a high incidence of abortions and malformations in the families of two sisters who were identical twins. No record of a similar case has been found in the literature of anencephaly.

Several studies have been published on the association of anencephaly with maternal age and parity. Malpas (1937) and Penrose (1946) concluded that the incidence of anencephaly was greater in the older age groups, but Record and McKeown (1949), Carter (1950), and Böök and Rayner (1950) considered that maternal age had little or no bearing in incidence. Our findings indicate a sharp increase in incidence at maternal ages over 30. The effect of parity is less clear because of its correlation with maternal age. Record and McKeown (1949) found that anencephaly was more likely to occur in first births and in births from the sixth onwards, and Ingalls, Pugh and MacMahon (1954) are in general agreement with this. On the other hand, Böök and Rayner (1950) concluded that anencephaly was distributed at random through the different birth ranks. In our material, when allowance has been made for maternal age, the association between anencephaly and parity is not significant. The higher incidence of primiparae among our control mothers in a hospital population may explain the discrepancy between our results and those of Record and McKeown (1949).

The fact that the patients in our series were interviewed made it possible to obtain information that would not have been available from hospital or other records, and since this interview took place shortly after the birth, the information is the more likely to be reliable. It is noteworthy that the occurrence of illness during the first 3 months of pregnancy was much more frequent in the mothers of anencephalics than in the control group, even though no particular illness seemed to be of special importance.

Since we were able to support a clinical assessment with objective tests, the results bearing on nutritional state are of interest. There would seem to be a definite association between anencephaly and defective nutrition. Of the other workers who have considered this question, or the related question of the association of severe congenital defects with social class, only Walker (1954) noted a similar tendency. The relation of nutrition to the occurrence of congenital deformities has been reviewed by Hogan (1953).

Evidence of nutritional defects in our series was to some extent unexpected because of a previous finding (Irish National Nutrition Survey, 1948; Jessop, 1950) that the average intake of most nutrients was high in the great majority of the population. However, in the lower income groups in Dublin and other towns, the average intake according to the Survey was below the recommended allowance in the case of calcium, vitamin A, riboflavin, and vitamin C. Furthermore, the finding of a satisfactory average intake in a group of people is no guarantee that all members of the group are adequately nourished.

Moreover, it must be remembered that malnutrition is only one aspect of a general low standard of living. The incidence in one of the hospitals from which our material was derived was very much higher than in either of the other two hospitals. This hospital is situated in a very poor part of the city and its patients come partly from the surrounding area and partly from a new housing estate in which most of the inhabitants are carrying the heavy burden of furnishing a house in addition to bringing up a young family. This peculiarity of distribution requires further investigation and a direct inquiry into the relation of living conditions to the occurrence of anencephaly in Dublin has been planned.

Summary

(1) The results of a study of 137 cases of anencephaly that occurred in three Dublin maternity hospitals between March 1, 1953, and April 30, 1955, are presented. Information about familial and environmental factors was obtained from the mothers at the time of the birth, and the results were compared with those of a control group.

(2) The incidence (per 1,000 hospital births) was 5·9; in one of the three hospitals it was 8·6. The

ratio of males to females was 1 : 4·2. The preponderance of females was less in the more mature groups and was absent in those born alive or recently dead and weighing 2,000 g. or more. A high proportion of foetuses were immature, judged either by weight or by period of gestation.

(3) Other congenital deformities were present in about 13 per cent. of anencephalics; the majority involved the central nervous system.

(4) The incidence of anencephaly was significantly higher in the babies of mothers over 30 years of age. Allowing for the influence of maternal age, differences between affected and controls in relation to parity were not significant.

(5) The proportion of mothers of blood group O was significantly higher for anencephalics than for controls or for the general population.

(6) The mothers of anencephalics had significantly lower haemoglobin and plasma protein levels than the controls. There was also some indication that the state of nutrition assessed clinically was lower in the mothers of anencephalics, and 10 per cent. of the husbands of these women were unemployed.

(7) Excessive vomiting during pregnancy did not appear to bear any clear relation to anencephaly, but there was some evidence that mothers of anencephalics experienced more illness during the first 3 months of pregnancy than the mothers of the controls.

(8) The incidence of congenital deformities in previous births to mothers of anencephalics was four times higher than in those to mothers of controls; the incidence of abortions and miscarriages was almost double.

(9) Congenital abnormalities had occurred more frequently in the families of the fathers and mothers of anencephalics than in those of the parents of the controls.

We are glad to acknowledge our indebtedness to the Masters of the three maternity hospitals and their staffs, especially Sister O'Malley, National Maternity Hospital, Sister Fitzgerald and Miss Aherne, Rotunda Hospital, and Sister McCabe, Coombe Hospital. Mr. E. H. Thornton, Lecturer in Statistics, Trinity College, Dublin, gave us much help with statistical questions and analysed the results, and Mr. G. W. P. Dawson, Lecturer in Botany, Trinity College, Dublin, contributed many valuable suggestions on genetical aspects. Finally, we wish to thank Mrs. E. McSweeney and Miss M. Hanna for help in the preparation of the Tables and typescript.

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"SOCIAL CLASS" GRADIENT IN SCHIZOPHRENIA

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Introduction

An understanding of the intricate relationship between an illness and the socio-economic complex of urban society is essential for its prevention. Are social, economic, occupational, or family circumstances associated with the illness? If so, are they causally connected or are they the results of the illness itself? Are unfavourable social or economic factors connected with contracting the illness (inception), or do they operate only against the recovery of affected persons (prevalence)? Is the association between the inception of illness and environmental factors directly proportional, or do the latter enter into effect only beyond some threshold of social tolerance? Does the relationship between illness and environmental factors affect both sexes and all age groups similarly? Do social or occupational factors operate in the same way in different cities or in different communities within the same city? These are only a few of the questions to which social and preventive medicine needs answers.

Some of these problems have been investigated in respect of acute physical illnesses such as infectious diseases, which become conspicuous fairly quickly after inception and for which the identification of the illness is relatively straightforward; but the identification and separation of socio-economic and family factors is by no means straightforward. In mental illness, however, there are additional difficulties, as for example the unknown interval between the inception of illness and its manifestation, and between the latter and the demand for medical care; and there are further problems of precise diagnostic criteria and identification of mental illness outside hospital. It is not surprising, therefore, that as yet there are few conclusive findings on the relationship between mental illness and specific socio-economic factors; opinions on the possible reasons for—and even on the existence of—such relationships diverge considerably.

Investigations into the hospital-treated prevalence of total psychiatric illness have agreed on the "social class" gradient—the increase in prevalence with decrease in socio-economic status; but for individual diagnoses the findings have by no means agreed. Faris and Dunham (1939) found correlations between specific diagnoses and indices of social isolation, and for schizophrenia in particular they showed that prevalence was highest in the central areas of Chicago and decreased progressively towards the periphery; however, studies of incidence in some cities of different types, as for example Kansas City (Schroeder, 1942) or in Austin, Texas (Belknap and Jaco, 1953), did not find such a regular pattern. Again, the findings in Bristol of Hare (1956) agreed with the Chicago findings in regard to male schizophrenics but differed somewhat for female schizophrenics; moreover, Hare found no association between the organization of the city and either manic depressive psychosis or the psychoses of old age.

The social class gradient in schizophrenia, observed in all studies in which a definite socio-occupational index has been used, has led to widely divergent hypotheses. Some investigators have construed the class gradient as resulting from downward occupational mobility—"drift"—of schizophrenics before reaching medical attention, while others have postulated other factors connected with job-selection; for example Clark (1948) suggested that certain occupations and also low pay aggravated pre-schizophrenic problems, and Ødegaard (1956) that schizophrenic persons tend to go into, and remain in, stationary or decreasing occupations rather than expanding occupations. Other investigators have considered that occupational mobility features are not relevant; Hollingshead and Redlich (1955), in a small

sample study, found that schizophrenics were more upwardly mobile than the average population, "achievers and possibly over-achievers"; and in a comprehensive study of the prevalence of treated schizophrenia in New Haven, Hollingshead and Redlich (1954) found that the marked social class gradient reflected class differences both in treatment and in rehabilitation, and suggested that "lower class living" fosters social isolation.

As regards other diagnoses, and particularly manic depressive psychosis, there is not even agreement on the existence of a "class gradient". Various investigators have found that manic depressives are equally common in all socio-occupational classes (Clark, 1949; Hare, 1955), whilst others have observed manic depressive psychosis to be more common among persons of higher economic status (Malzberg, 1956a) or of higher education (Malzberg, 1956b). Conversely, other studies have found a class gradient in first admissions for manic depressive psychosis similar to, though less steep than, the class gradient in schizophrenia (Tietze, Lemkau, and Cooper, 1941); the comprehensive reports for England and Wales showed this gradient for male manic depressives in hospital in 1949 (Registrar General, 1953) and again in 1950 and 1951 (Registrar General, 1955). In the England and Wales admissions, the excess of manic depressive patients in Social Class V was most marked among young men and in age groups up to 45 years.

These divergent findings appear difficult to reconcile if social class, occupational class, economic status, level of education, socio-occupational status are all taken to be equivalent. If, however, these indices of social status are not equivalent, they may well be distributed rather differently from each other, and the use of one index rather than another may account for apparently conflicting findings. Moreover, the use of one index alone may give a distorted picture, since it is likely that social status, economic status, occupational class, and level of education are slightly differently related to mental illness, and all four (and perhaps more) indices should be investigated simultaneously in connexion with the inception and prevalence of the various mental illnesses.

Material

The published data on all mental hospital patients in England and Wales in the years 1949 to 1951 indicated the prevalence of hospitalized illness, but cannot be taken as indicating inception, since first admissions were not distinguished from re-admissions. It was possible, therefore, that the marked excess of men from *Social Class V might be weighted by re-admissions, and might reflect class differences in ability to care for the mentally ill rather than a class gradient in the occurrence of mental illness. If social class (as judged by occupation) were the predominent environmental factor associated with the inception of mental illness, and if Social Class V had truly a higher inception rate, particularly of schizophrenia, then it might be expected that first admission rates for schizophrenia would be significantly higher in typical Class IV–V areas, where the men were mainly in semi-skilled or unskilled work, than in typical Class I–II areas, where the men were mainly in managerial or professional occupations. In order to examine this hypothesis, first admissions for selected diagnoses in 1954 and 1955 were studied in a group of four East London boroughs ('E') and a group of five West London boroughs ('W'). The East London boroughs were outstanding in the 1951 Census for their high proportions—as compared with London as a whole—of enumerated men (occupied and retired) in Social Classes IV and V; conversely, the West London boroughs were outstanding for their high proportions of enumerated men in Social Classes I and II (General Register Office, 1953).

The diagnoses studied for persons aged 15 to 59 years were schizophrenic disorders, manic depressive reaction, and psychoneurotic disorders; and for persons aged 60 to 79 senile psychosis and psychosis with cerebral arteriosclerosis. With the co-operation of the General Register Office, data were obtained on all 1954 and 1955 first admissions from any address in the 'E' and 'W' boroughs, tabulated by diagnosis, sex, broad age group, and (for those stating occupation) social class. These admissions were then related to the populations at risk in several ways. Age-sex populations for 'E' and 'W', based on the enumerated population of each borough in the 1951 Census, were used to calculate age-sex rates of first admission. Social class populations of occupied and retired men in 'E' and 'W', based on the enumerated men in each borough in the 1951 Census, were used to calculate crude social class rates, and were further used in conjunction with the Occupation Tables of 1951 (General Register Office, 1956) to make population estimates of men aged 15–59 who were occupied as distinct from those who were retired or those who were unoccupied. From these estimates, a second series of population estimates was made of age group by social class of occupied men in 'E' and 'W', on the basis of interpolations from the age-distributions of

* The term "Social Class" used here and in subsequent paragraphs is, strictly speaking, "occupational class", and is based on the Registrar General's "Classification of Occupations, 1950" (General Register Office, 1951).

men in different occupations in England and Wales as shown in the One Per Cent. Sample (General Register Office, 1952). Using these estimated populations of occupied, retired, and unoccupied men by age group and social class, "index" rates of first admission for each age-social-class group in 'E' and 'W' have been derived; clearly, however, these index rates are very speculative.

In addition to the analyses of age-sex and social-class specific rates of first admission, various social and demographic characteristics of 'E' and 'W' have been analysed. Though these relate to 'E' and 'W' and cannot be related directly to the persons who were admitted to mental hospitals from these areas, they illuminate certain features in 'E' and 'W', and suggest that, in future investigations, data on several other factors as well as occupation should be examined.

(1) First Admission Rates in the 'E' and 'W' Boroughs

General Findings.—The population in the four 'E' boroughs was approximately half of that in the five 'W' boroughs; in the 1951 Census, 'E' had 173,710 persons aged 15–59 years and 37,891 persons aged 60–79 years, whereas 'W' had 337,398 and 76,509 respectively. The first admissions in 1954 and 1955 for schizophrenic disorders, manic depressive reaction, and psycho-neurotic disorders totalled 271 from 'E' and 759 from 'W'; and the first admissions for senile psychosis and psychosis with cerebral arteriosclerosis numbered 69 from 'E' and 123 from 'W'.

Considering first the three diagnostic groups in the age band 15–59 years, Table I shows that the 'E' rate, 7·80 per 10,000 persons (8·06 for males, 7·55 for females), was very significantly lower than the

TABLE I

FIRST ADMISSIONS TO MENTAL HOSPITALS FROM 'E' AND 'W' BOROUGHS OF LONDON, 1954–55
Rates (Annual Average) per 10,000 Population in each Age-Sex Group

Diagnosis	Boroughs	Sex	Age Group (yrs)			Total (15–59 yrs)	
			15–29	30–49	50–59	Crude	Standardized*
Schizophrenic Disorders	'E'	Persons ..	2·37	2·23	0·67	2·02	1·95
		Males ..	3·69	3·08	1·08	2·98	2·93
		Females ..	1·17	1·32	0·31	1·08	1·07
	'W'	Persons ..	4·88	4·15	3·46	4·25	4·25
		Males ..	5·55	3·80	1·72	3·99	4·01
		Females ..	4·39	4·44	4·63	4·46	4·46
Manic Depressive Reaction	'E'	Persons ..	1·22	3·44	9·21	3·60	3·80
		Males ..	1·12	2·71	8·62	3·09	3·21
		Females ..	1·32	4·22	9·73	4·09	4·32
	'W'	Persons ..	1·83	3·99	8·38	4·14	4·04
		Males ..	1·17	3·46	7·08	3·37	3·34
		Females ..	2·31	4·44	9·26	4·72	4·67
Psycho-neurotic Disorders	'E'	Persons ..	1·15	2·80	2·85	2·19	2·28
		Males ..	1·12	2·34	2·87	1·98	2·04
		Females ..	1·17	3·30	2·82	2·39	2·49
	'W'	Persons ..	2·83	2·70	3·31	2·86	2·84
		Males ..	2·99	2·24	2·87	2·59	2·59
		Females ..	2·71	3·09	3·60	3·07	3·06
Total (Three Diagnoses	'E'	Persons ..	4·74	8·47	12·73	7·80	8·03
		Males ..	5·94	8·13	12·57	8·06	8·18
		Females ..	3·65	8·84	12·86	7·55	7·89
	'W'	Persons ..	9·54	10·84	15·15	11·25	11·12
		Males ..	9·71	9·49	11·67	9·95	9·94
		Females ..	9·41	11·96	17·49	12·25	12·19

'E' Boroughs: Bethnal Green, Poplar, Shoreditch, Stepney.
'W' Boroughs: Chelsea, Hampstead, Kensington, St. Marylebone, Westminster.

* Standardized rates in final column standardized to age-sex composition of London population aged 15–59 yrs, *i.e.* adjusted to make due allowance for the different compositions of the 'E' and 'W' borough groupings

'W' rate, 11·25 (9·95 for males, 12·25 for females). A considerable portion of the excess of the 'W' over the 'E' rate was due to the large number of women from 'W' admitted to mental hospitals; whereas the 'E' female rate of first admission was a little lower than the 'E' male rate, the 'W' female rate was considerably higher than the 'W' male rate. As the age and sex composition of the 'E' population differed somewhat from that of the 'W' population, the crude rates were adjusted to a common standard population; though the standardized rates were slightly different from the crude rates, the 'E'–'W' comparison was not seriously affected. It appears, therefore, that the 'E' rates were lower than the 'W' rates for both males and females; for males, the difference was statistically only suggestive, but for females the difference was highly significant.

This difference, however, did not occur equally in all three diagnostic categories. For manic depressive reaction and for psychoneurotic disorders, there was only a small (and not significant) excess in the 'W' rate as compared with the 'E' rate, and this was of similar order for both males and females. But for schizophrenic disorders, the 'W' rate was considerably higher than the 'E' rate, and this was particularly marked for females, the 'W' rate, 4·46, being more than four times the 'E' rate, 1·08. Indeed, the 'W' female schizophrenia rate was slightly higher than the 'W' male schizophrenia rate.

Apparently, then, the hypothesis that 'E' would have a higher first-admission rate than 'W' has not been confirmed; 'W' admissions exceeded those from 'E'. This excess arose from two sources: a small but consistent excess of 'W' cases in each diagnostic category and for each sex; and a highly significant excess of women admitted from 'W' for schizophrenic disorders.

Considering secondly the psychoses of the elderly—senile psychosis and psychosis with cerebral arteriosclerosis—in the age band 60–79 years, Table II shows that the comparison between 'E' and 'W' was more in accord with the original hypothesis, in that the total rate in 'E' was higher than that in 'W'. The 'E' first-admission rate was 9·11 per 10,000 persons (6·34 for males, 11·25 for females) and the 'W' first-admission rate was 8·04 (5·42 for males, 9·52 for females); though the difference was small and not significant, it occurred in each age-sex group. The standardized rates differed slightly from the crude rates, but the 'E'–'W' comparison was not affected.

When these two diagnostic categories are considered separately, it would appear that psychosis with cerebral arteriosclerosis was less frequently diagnosed in persons from 'E' than in persons from 'W', and less frequently in women than in men. For the category "senile psychosis", the 'E' rate, 8·18, was higher that the 'W' rate, 6·47; and within both 'E' and 'W' the female rates were significantly higher than the male rates. Yet for the category "psychosis with cerebral arteriosclerosis", the 'E' rate, 0·92, was less than the 'W' rate, 1·57; moreover, within both 'E' and 'W', the female rates were lower than the male rates. Though the 'W' excess in admissions for psychosis with cerebral arteriosclerosis was not statistically significant, the number of cases being relatively small, and though the excess of male rates over female rates in this diagnostic category was statistically only suggestive, both these excesses were in marked contrast to the overall pattern for the elderly (namely, of 'E' rates higher than 'W' rates, and of female rates higher than male rates).

AGE-SEX SPECIFIC RATES.—For the three diagnoses investigated for the age band 15–59 years, Table I shows the age-sex specific rates for each as well as the total rates discussed above. Fig. 1 (opposite) illustrates the age trends.

Schizophrenia.—The age trend in males followed the accepted pattern, and the 'E'–'W' difference was consistent, though not statistically significant; the age trend in females, particularly in 'W', was quite contrary to the accepted pattern, and the 'E'–'W' difference was highly significant for each age group. In addition, there seemed to be a higher incidence of schizophrenic disorders in 'W' among older women than among men, and the female rate in the age group 50–59 years was significantly higher than the male rate.

Manic Depressive Reaction.—There was a steady rise in the first-admission rate with rising age, in both 'E' and 'W' for both men and women; and at each age the female rate was higher than that for males. Comparing 'E' with 'W', in the younger age groups the 'W' rates were slightly higher than the corresponding 'E' rates; but at 50–59 years, the 'E' rates both for men and women rose above the 'W' rates.

Psychoneurotic Disorders.—These gave rather smaller rates than the previous diagnoses, and the age trend was not regular. In general, the older age groups had higher rates than the younger, and women had higher rates than men; a notable exception was seen in 'W' men aged 15–29 years, who had a higher rate than older men or than women of the same age (and more than double the rate for manic depressive psychosis in their own age group). As noted earlier, 'W' had a small overall excess of

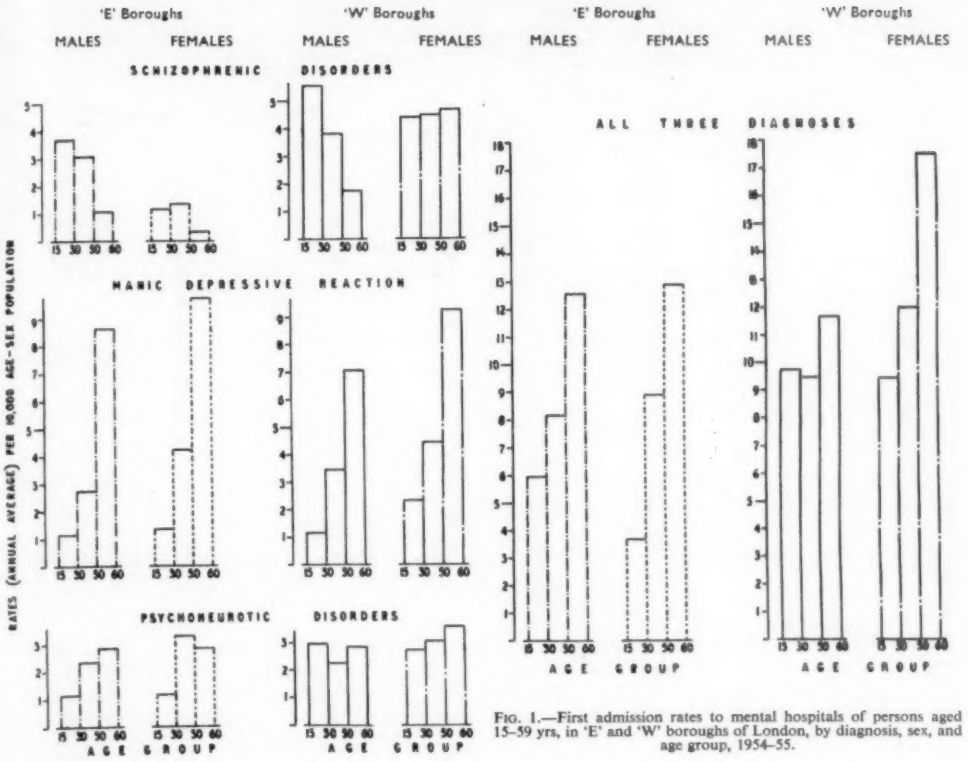

FIG. 1.—First admission rates to mental hospitals of persons aged 15–59 yrs, in 'E' and 'W' boroughs of London, by diagnosis, sex, and age group, 1954–55.

psychoneuroses as compared with 'E'; Fig. 1 shows that this 'W' excess was not evenly distributed through the age groups, but occurred almost entirely in the 15–29 year age groups in both men and women.

The Three Diagnoses Combined.—The picture was somewhat similar to the picture for manic depressive psychosis; in general, there was a rising age trend, the female rate being higher than the male rate and the 'W' rate higher than the 'E' rate in most age groups. However, there were several marked divergencies from this general pattern, especially at ages 15–29 years; in this age group, the male rate exceeded the corresponding female rate in 'E' as well as in 'W', and in 'W' the male rate for this age group was higher than in the age group 30–49 years.

For the psychoses of the elderly, the age-sex specific rates as well as the total rates are shown in Table II and Fig. 2 (overleaf).

Senile Psychosis.—The age gradient was steep and the rates at ages 70–79 years greatly exceeded those at 60–69 years. In each age group the female rates were higher than the male rates, and the 'E' rates slightly exceeded the corresponding 'W' rates.

Psychosis with Cerebral Arteriosclerosis.—This appeared to have quite a different pattern, and the anomaly already mentioned—of higher male than female rates and higher 'W' than 'E' rates—revealed an even more curious divergence from expectation, in that the incidence of this diagnosis apparently decreased as age increased. For both males and females in 'E' and for females in 'W', the rates at ages 70–79 were considerably lower than those at ages 60–69 years. It is difficult to reconcile such an age trend with the general 'E' and 'W' pattern of psychoses of the elderly, and it seems reasonable to suppose that the anomaly is one of diagnostic practice.

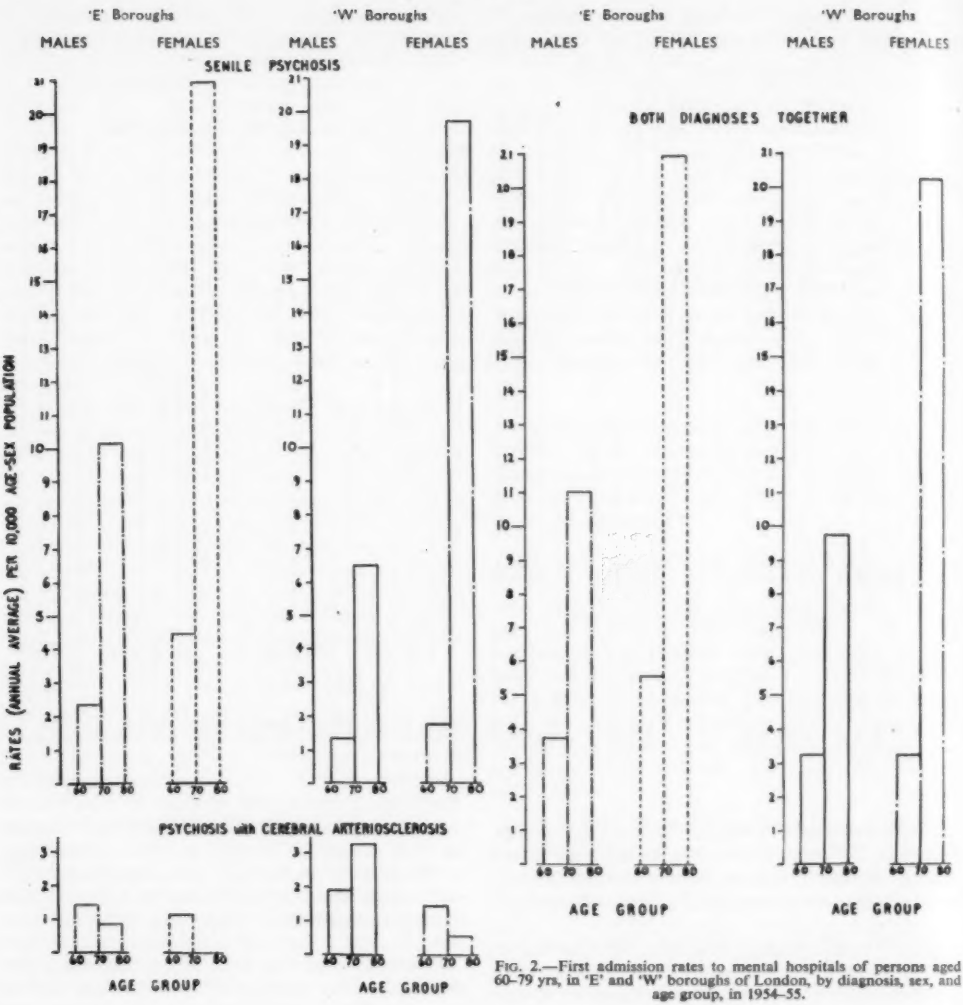

FIG. 2.—First admission rates to mental hospitals of persons aged 60–79 yrs, in 'E' and 'W' boroughs of London, by diagnosis, sex, and age group, in 1954–55.

"SOCIAL CLASS" SPECIFIC RATES FOR OCCUPIED MEN.—As the 1951 Census data on the "social class" composition in 'E' and 'W' relate only to men of all ages and combine retired with occupied, estimates of the social class composition of the female population in these areas, or of that of men aged 60–79 years, were too speculative to be used in calculating rates. The following paragraphs, therefore, discuss only the first-admission rates of men aged 15–59 whose occupation was recorded. Since the "populations at risk" were estimated, as previously described, from the occupied and retired men of all ages, and since moreover those admitted to hospital with no occupation recorded, or described as unoccupied (7½ per cent. of all male admissions in this age group) were excluded from the social class rates, these rates should be considered as relative estimates and not as absolute figures.

TABLE II

FIRST ADMISSIONS TO MENTAL HOSPITALS FROM 'E' AND 'W' BOROUGHS OF LONDON, 1954–55

Rates (Annual Average) per 10,000 Population in each Age-Sex Group

Diagnosis	Boroughs	Sex	Age Group (yrs)		Total (60–79 yrs)	
			60–69	70–79	Crude	Standardized*
Senile Psychosis	'E'	Persons	3·53	16·32	8·18	8·41
		Males	2·35	10·17	5·14	5·07
		Females	4·46	20·91	10·54	10·66
	'W'	Persons	1·62	15·22	6·47	6·36
		Males	1·36	6·50	3·07	3·14
		Females	1·79	19·68	8·39	8·53
Psychosis with Cerebral Arterio-Sclerosis	'E'	Persons	1·24	0·36	0·92	0·90
		Males	1·41	0·85	1·21	1·21
		Females	1·12	0·00	0·70	0·70
	'W'	Persons	1·62	1·47	1·57	1·62
		Males	1·90	3·25	2·35	2·37
		Females	1·46	0·55	1·13	1·12
Total (Two Diagnoses)	'E'	Persons	4·77	16·68	9·11	9·31
		Males	3·75	11·02	6·34	6·28
		Females	5·58	20·91	11·25	11·36
	'W'	Persons	3·25	16·68	8·04	7·98
		Males	3·26	9·75	5·42	5·51
		Females	3·25	20·23	9·52	9·65

* Standardized rates shown in final column standardized to age-sex composition of London population aged 60–79 yrs, *i.e.* adjusted to make due allowance for the different compositions of the 'E' and 'W' borough groupings.

Table III shows the estimated "social class" rates in 'E' and 'W' and also in all nine boroughs combined. Social Classes I and II, and also IV and V, were grouped together because of the small populations at risk in some of the borough-class groups and the relatively large number of admissions with unknown occupation. Taking all three diagnoses—schizophrenia, manic depressive psychosis, and psychoneuroses—together, a class gradient is seen in both 'E' and 'W', i.e. an increase in admission rates with

TABLE III

FIRST ADMISSIONS TO MENTAL HOSPITALS OF OCCUPIED MALES FROM 'E' AND 'W' BOROUGHS OF LONDON, 1954–55

Rates (Annual Average) per 10,000 Males in each Social-Class Group

Diagnosis	Boroughs	Social Class of Occupied Males			Social Sub-Class*			
		I and II	III	IV and V	IIIc	Rest of III	IV + Va	Vb
Schizophrenic Disorders	'E'	(2·73)	2·21	3·04	1·61	2·25	3·07	2·99
	'W'	2·32	3·07	5·38	4·13	2·87	2·79	9·11
	Total	2·37	2·72	4·11	3·57	2·61	2·94	5·75
Manic Depressive Reaction	'E'	(0·00)	2·42	3·04	1·61	2·48	2·41	3·89
	'W'	2·74	2·71	4·49	5·05	2·28	3·04	6·56
	Total	2·37	2·59	3·70	4·29	2·36	2·71	5·09
Psycho-neurotic Disorders	'E'	(0·68)	2·10	1·65	3·22	2·03	1·10	2·39
	'W'	2·11	2·43	2·84	3·22	2·28	2·54	3·28
	Total	1·92	2·30	2·19	3·22	2·17	1·76	2·79
Total (Three Diagnoses)	'E'	(3·41)	6·73	7·72	6·44	6·75	6·58	9·27
	'W'	7·16	8·20	12·71	12·40	7·43	8·37	18·95
	Total	6·66	7·61	10·01	11·08	7·14	7·41	13·63

Class IIIc—Clerical Workers; rest of Class III—All Other Skilled Workers; Class Va—Building and Dock Labourers; Class Vb—All Other Unskilled Workers

decrease in social class. In the aggregate of nine boroughs, this gradient was regular, but in 'E' the gradient from Social Class III to Social Classes IV and V was very small, whereas in 'W' it was marked. (When the five social classes were taken separately, the 'E' rate for Class IV was the same as that for Class V and very little higher than for Class III; by contrast, the 'W' rate for Class V was nearly double that for Class IV.) For each social class group, the excess of the 'W' rate over the 'E' rate was consistent, and for Classes IV–V this excess was highly significant.

For individual diagnoses, the numbers in each class group were small and the class gradient was not consistent.

Schizophrenia.—In 'W', as in the nine boroughs taken together, the gradient was regular; yet 'E' had no apparent class gradient, and the rates for Classes IV–V and Classes I–II (the latter based on only four admissions in the 2 years) were of similar order, and little higher than the Class III rate. Comparing 'E' with 'W', the overall 'W' excess was clearly apparent and for Classes IV–V was highly significant. Yet, when the more detailed sub-divisions of the social classes were studied, the 'W' excess in the overall rate was almost entirely due to the high 'W' rate in two sub-classes: in Class IIIc (male clerical workers) the 'W' rate, 4·1, was more than double the 'E' rate, 1·6; and in Class Vb (labourers, excluding those in building and dock work) the 'W' rate, 9·1, was three times the 'E' rate, 3·0 (and more than double any other sub-class rate in 'W').

Since the original hypothesis was formulated in connexion with the social class factor in schizophrenia, the more detailed rates for social sub-classes are worthy of note. In 'E' the class trend was small and almost all the rates fell within a narrow range of 2·3 to 3·1, the exceptions being the lower rates of 1·5 for Class II and 1·6 for Class IIIc. By contrast, in 'W' the rates ranged more widely; the lowest rate, again in Class II, was 1·7, and (except for clerical workers in Class IIIc who had a rate of 4·1) there was a steady gradient to the Class Va (building and dock labourers) rate of 4·0, and then a marked rise to the Class Vb rate of 9·1.

Manic Depressive Reaction.—Both 'E' and 'W' rates showed some class gradient, though in a somewhat different form; in 'W' the rate for Classes IV–V was in excess (though not significantly) of the rates for other classes. When the more detailed sub-classes were examined, the gradient was again largely due to the high 'W' rates in Class IIIc and Class Vb; yet in 'E', the Class IIIc rate was again one of the lowest among all the sub-classes. Taking all nine boroughs together, the class gradient was similar to, though less steep than, the gradient in schizophrenia rates.

Psychoneuroses.—No significant social class gradient was discernible in either 'E' or 'W'; indeed, for the aggregate of all nine boroughs, the rates for Classes I–II, Class III, and Classes IV–V were very similar. For more detailed sub-classes, the rates were also very similar and fell within a relatively narrow range (Fig. 3, opposite).

It is impossible to draw firm conclusions from rates calculated for such small numbers of 'E' and 'W' admissions and from estimated populations in the social classes and sub-classes. It would seem, however, that the experience of men in the 'E' boroughs, which were selected as typical Class IV–V boroughs, was not very different among Class IV–V men than among Class III men; moreover, the experience in respect of schizophrenia appeared to be no worse than that for manic depressive psychosis. On the other hand, in the 'W' boroughs, which were selected as typical Class I–II boroughs, the experience of men in Classes IV–V and especially in Sub-Class Vb was markedly worse than that of other 'W' men or of Class IV–V men in 'E'; and this gradient occurred most noticeably in the diagnosis of schizophrenia in 'W' men. If these findings on the basis of the estimated social class rates represent genuine differences between 'E' and 'W', there could be a variety of possible explanations: diagnostic practice, short-term residence in 'W', foreign-born or foreign-culture immigration into 'W', 'drift' into labourers' jobs, local attitudes to Class V jobs, large proportions of single men or men living alone or in lodgings, differences in age composition for similar occupations in 'E' and 'W', could all contribute to the excess of 'W' over 'E' admission rates.

In an attempt to find whether differences in age-social-class composition contributed to the excess of first admissions from 'W', two series of population estimates were made, as already described. The "index" rates calculated from these hypothetical populations were extremely speculative, the more so because the number of first admissions in each age-social-class group was very small, and therefore no tables of these index rates are quoted.

The first series of estimates was made for "occupied" as compared with "unoccupied and retired" men in each age group; these might have revealed a significantly higher admission rate for unoccupied men in one or more age groups. However, this hypothesis was not supported by the index rates; indeed, for manic depressive reaction and for psychoneurosis, the rates for occupied men in 'W' appeared to be

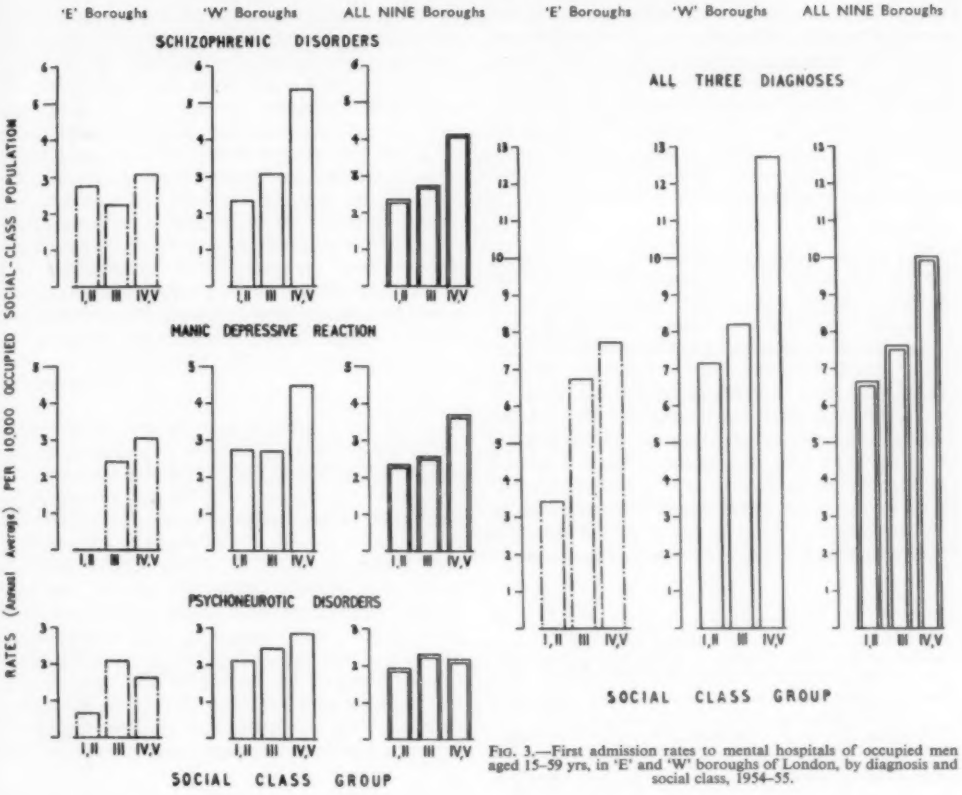

FIG. 3.—First admission rates to mental hospitals of occupied men aged 15–59 yrs, in 'E' and 'W' boroughs of London, by diagnosis and social class, 1954–55.

higher than those for unoccupied men. Comparing 'E' and 'W' rates for occupied men, it would seem that occupied males aged 15–29 years in 'W' had a rather higher schizophrenia rate than the corresponding group in 'E', but at older ages the 'E' and 'W' rates appeared to be very similar.

The second series of estimates was made for the age-composition in each of the Social Class groups I–II, III, and IV–V in 'E' and 'W'; this might have revealed that the Class V excess in the 'W' rates was in reality a reflection of the younger age-composition of Class V, or conversely, that the apparent absence of a social class gradient in the 'E' rates was an artefact, due largely to, for example, a young Class III and an elderly Class V population. This hypothesis, however, was not confirmed by the index rates, from which no regular age-class trend in either 'E' or 'W' was disclosed. There were several age-social-class groups in which the 'W' rates appeared to be rather higher than the 'E' rates, but these groups were not distributed in any orderly pattern and led to no conclusion.

(2) Demographic and Social Features in the 'E' and 'W' Boroughs

It has already been stated that various explanations could account for the apparent contradiction between the "social class" gradient in admission rates within each group of boroughs—particularly the Class V excess in 'W'—and the higher level of rates, particularly for schizophrenia, in the so-called Class I–II 'W' boroughs. Clearly the social class factors operate in a more complex manner than that of a one-dimensional or proportional relationship. To investigate the interaction of the various component factors in the "social complex" would require more

detailed information on each person admitted and more comparable information on the population in 'E' and 'W' than is at present available. There are, however, certain data available on 'E' and 'W' which suggest that 'W' should not be regarded as a "typically well-to-do" area, and that, in comparing the single dimension of occupational social class, important differences in composition and stability between 'E' and 'W' have not been taken into account.

POPULATION COMPOSITION.—As 'E' and 'W' were selected for their high proportions of men at opposite ends of the social class scale, it is of interest to compare each area with London as a whole. The distribution of occupied and retired men enumerated in the 1951 Census is shown in Table IV. 'E' did indeed have a high proportion of men in Classes IV and V, the excess in Class V relative to the London average being even greater than the excess in Class IV; at the same time, the relative deficit in Classes I and II was most marked in Class I. Conversely, 'W' had a greater excess relative to the London average in Class I than in Class II, and a greater deficit in Class V than in Class IV.

TABLE IV

SOCIAL CLASS DISTRIBUTION OF ENUMERATED MEN (OCCUPIED AND RETIRED), CENSUS 1951

Boroughs	Percentage of Men (Occupied and Retired) in Social Class					Total
	I	II	III	IV	V	
'E'	0·7	6·7 (7·4)	50·0	15·4	27·2 (42·6)	100
'W'	12·3	21·1 (33·4)	44·3	10·4	11·9 (22·3)	100
London A.C.	4·0	13·0 (17·0)	54·2	11·9	16·9 (28·8)	100

Although, according to the occupations of the men enumerated in 'W', it appeared to be an "upper class" area, several reservations are necessary. First, 8 per cent. of the men enumerated in 'W' were not resident in the area; 'W' contains major railway stations and a large number of hotels, boarding and guest houses, lodgings, and hostels. More than half of London's hotels and boarding houses with ten or more rooms were in 'W'; and 'W' contained more than two-thirds of London's "visiting guests" and more than half of the "resident guests" in establishments of this size at the 1951 Census. Secondly, the occupied and retired men (on whose occupations, present or past, the social class composition is based) should correspond with the total enumerated adult males, since non-residents as well as residents stated their occupations. In 'E' this was so; but in 'W' it would seem that 8 per cent. of the adult men had neither present nor past occupation, for the proportion of occupied and retired men was only 90 per cent. of the total adult males, and visitors from foreign or colonial countries or from the Commonwealth accounted for only 2 per cent. Though these proportions of non-resident and unoccupied men are not large enough to reverse the overall social class composition in 'W', they indicate that the "upper class" 'W' boroughs include a less settled population than the 'E' boroughs.

AGE AND SEX COMPOSITION.— Another aspect of the difference between 'E' and 'W' is visible in the sex and age distribution. In 'E' the sex ratio was 105 females to 100 males; in 'W' it was 132—a highly significant excess. Moreover, the 'E' population, especially the female, was significantly younger than the 'W' population. In 'E', 22 per cent. of the population were children under 15 years of age, and another 24 per cent. were young adults aged 15–29 years; in 'W', only 14 per cent. were children under 15 years of age and 22 per cent. were young adults (Table V, opposite). At age 30 and upwards, 'W' had higher proportions than 'E', and the divergence widened with increasing age, so that the elderly formed a significantly greater proportion in 'W' than in 'E'.

An overall excess of females over males is a normal demographic feature due to the greater mortality of men in the older age groups; in countries with low infant mortality and good public health services, there is normally an excess of males over females at ages below 50 years. A striking indication of the unusual sex ratio in 'W' in comparison with the normal pattern seen in 'E' is the distribution by age, illustrated in Fig. 4 (opposite).

In 'E' there were fewer females than males in the age groups below 50 years (except at ages of call-up for men), and with increasing age the female preponderance increased progressively, so that among the elderly the ratio was 132:100. In 'W' the female: male ratio for children under 15 years was similar to that in 'E', but at all higher ages the ratio, though distributed in similar pattern, was at a significantly higher level than in 'E'. Even at marriageable and reproductive ages, the excess of women in 'W' was marked; and among the elderly the ratio reached 184:100.

TABLE V

DEMOGRAPHIC AND SOCIAL CHARACTERISTICS IN 'E' AND 'W' BOROUGHS OF LONDON (CENSUS, 1951)

Characteristic				Boroughs 'E'	Boroughs 'W'
Total Population (all ages)	Sex Ratio (females per 100 males)			105	132
	Percentage of Population	aged 0–14 yrs		22	14
		aged 15–29 yrs		24	22
Single Persons aged 15–59 yrs	Sex Ratio (females per 100 males)			90	149
	Percentage of Population who were Single	aged 15–59 yrs	Male	34	38
			Female	30	43½
		aged 25–59 yrs	Male	21	27
			Female	17	35
Private Households	Percentage of Population	in Private Households		96	86
		in Non-Private Households		1	11
	One-Person Private Households	as Percentage of All Private Households		16	32
		as Percentage of Population		5	11½
	Two-Person Private Households as Percentage of All Private Households			27	31
	Percentage of Private Households having Married Couples as Heads			71	55
Place of Birth	Percentage of Population born outside United Kingdom and Ireland	Male		6½	19
		Female		5	17½
	Percentage of Population born in London	Male		77	41
		Female		79	36½

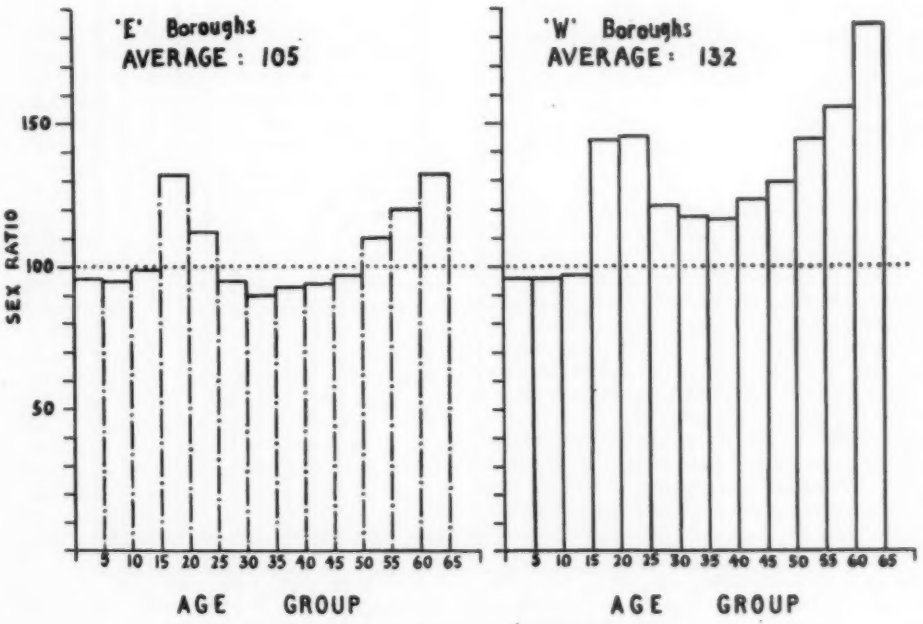

FIG. 4.—Sex ratio (females per 100 males) by age of all persons in 'E' and 'W' boroughs of London, 1951.

MARITAL STATUS.—In view of the high schizophrenia rates of first admission of 'W' women, and particularly the unusual rising age trend for women aged 30–59 years, the female:male preponderance warrants further scrutiny. Separate studies of the demographic patterns for single, married, widowed, and divorced persons showed that the age distribution of the married persons in 'W' was very similar to that in 'E'; and the proportions of widowed and divorced men and women, though slightly higher in 'W' than in 'E', did not account for the excess of women. This excess in 'W' was traceable entirely to single women, and was so great that, over the age range 15–59 years there were 149 single women to every 100 single men, whereas in 'E' the ratio averaged 90:100 (Fig. 5). Even at the modal age of marriage of women, 25–29 years, at which normally the lowest female:male ratio occurs. 'W' had more single women than men. At ages 45 and above, single women outnumbered single men by more than 2:1 the ratio rising to more than 3:1.

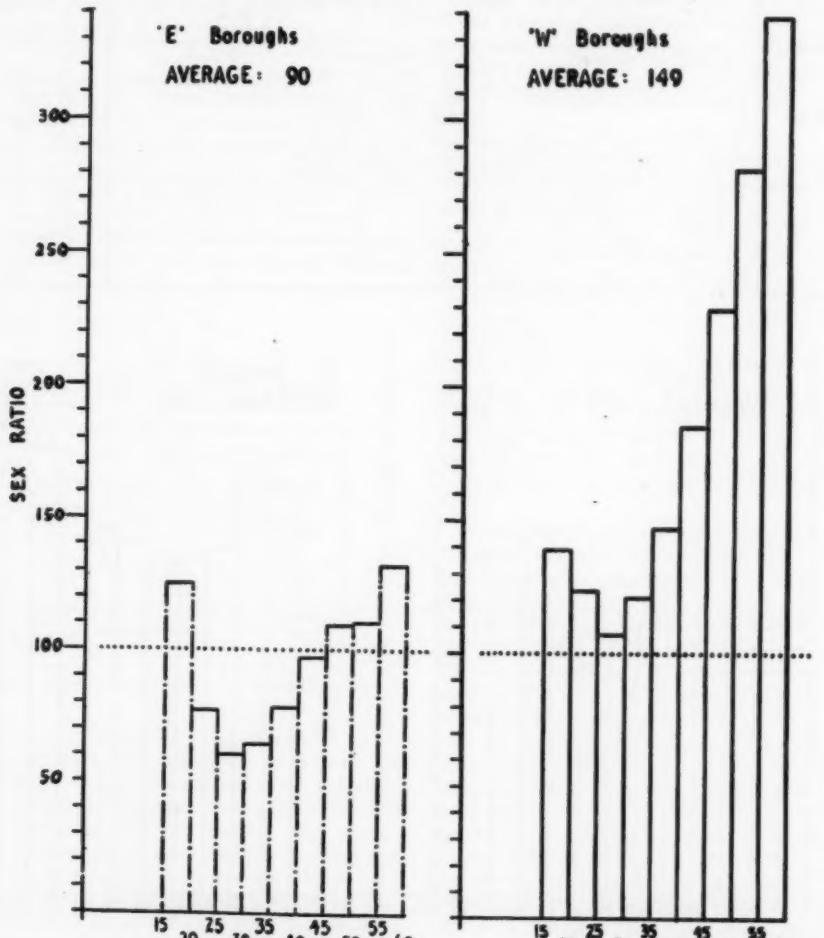

FIG. 5.—Sex ratio (single females per 100 single males) by age of single persons in 'E' and 'W' boroughs of London, 1951.

This remarkable preponderance of single women over single men would not in itself influence the population composition if single persons constituted a relatively small proportion of the total population. But this was by no means the case in the 'W' population, for single men as well as single women formed a significantly higher proportion than in the 'E' population; in 'E' 34 per cent. of the men and 30 per cent. of the women aged 15–59 years were single, but in 'W' 38 per cent. of the men and 43½ per cent. of the women in this age range were single. At ages below 25 years the proportions, as would be expected, were higher; in the age-range 25–59 years, however, the 'E'–'W' difference was even more marked, for in 'E' 21 per cent. of the men and 17 per cent. of the women were single, whereas in 'W' 27 per cent. of the men and 35 per cent. of the women were single (Table V). The difference in the proportion of single women is startling; it appears that in 'W' one woman in every three was single. Further study of the individual boroughs in 'W' disclosed that the female:male excess and the proportions of single women ranged very widely about the 'W' average; in Chelsea and in Hampstead particularly, the preponderance of women of 50 years and over and, among them, of single women was marked.

PRIVATE HOUSEHOLDS.—The Census Reports do not include information on the living circumstances of these single men and women in 'W', nor do they give direct data on people living alone. However, an index of persons living alone may be gained, first, from those in hotels, boarding-houses, and hostels, which are classified as "non-private households", and, secondly, from those private households which consist of one person only. (These data give only a minimum estimate of people living alone, since persons in lodgings, etc., are included in the private households in which they lodge.) In 'E', 96 per cent. of the population lived in private households and only 1 per cent. in "non-private households" (the remaining 3 per cent. being in hospitals, institutions, and the like). In 'W', only 86 per cent. of the population were in private households, and 11 per cent. were in "non-private households"; from other Census data, it would seem that the majority of those in non-private households were "resident guests" (approximately one-quarter being "visiting guests").

Other persons living alone were those forming one-person private households. In 'E' these comprised 16 per cent. of all private households, and these persons living alone constituted 5 per cent. of the population; in 'W' they were twice as numerous, comprising 32 per cent. of all private households, and forming 11½ per cent. of the population—one person in every nine. Altogether, persons in non-private households and those in one-person private households totalled 6½ per cent. of the 'E' population as compared with 22½ per cent. of the 'W' population; and, as already mentioned, these figures exclude lodgers and other single persons within private households, and therefore give an underestimate of persons living alone.

A further indication of the relative absence of family life in the 'W' boroughs comes from the high proportion of two-person households; in 'W' these formed 31 per cent. of all households (as compared with 27 per cent. in 'E'). Adding one-person and two-person households together, 63 per cent. (nearly two in every three) in 'W' were of this small size, so that only one in three private households *could* have formed a "family" in the usual sense (Table V).

Another aspect of family structure is the status of the head of household. Two categories are given in Census Reports: the "non-married" heads include single, widowed, divorced, or separated persons; the "married" heads include those still married during the Census, and therefore indicate that the household core was a married couple. In 'E', 71 per cent. of the private households had married heads, whereas in 'W' only 55 per cent. of the private households had married heads. It would appear, therefore, that the households which typify a settled family life were considerably less common in 'W' than in 'E', and this fact, together with the relatively high proportion in 'W' who live in non-private households, suggests factors of impermanence or instability in at least part of the 'W' population.

PLACE OF BIRTH.—Space does not permit discussion of the many differences in age and status of heads of 'E' and 'W' households, which further emphasize the dissimilarity between 'E' and 'W' families. One other feature relating to individuals—their place of origin—should be considered in view of the known studies on mental health and migration. In 'E', 6½ per cent .of the males and 5 per cent. of the females were born outside the United Kingdom or Ireland; in 'W', 19 per cent. of males and 17½ per cent. of females were born abroad. In most boroughs the foreign-born men were relatively more numerous than the foreign-born women, but in Chelsea and Hampstead the percentage of foreign-born women exceeded that of men.

Another aspect of geographical stability, the proportion of the population born in London itself, again reveals the dissimilarity between 'E' and 'W'. In 'E', 77 per cent. of males and 79 per cent. of females were London-born; in 'W' only 41 per cent.

of males and 36½ per cent. of females were London-born. This is perhaps another indication of a transient section within the 'W' population.

Discussion

The study of rates of first admission to mental hospitals from 'E' and 'W' was an attempt to determine whether the excess of hospital patients—and the marked excess of schizophrenics—from Social Class V shown by the Registrar General was a true measure of higher inception rates in Class V. The hypothesis was that, though part of the class gradient was probably a reflection of prevalence, there was a genuine class gradient in inception of mental illness. A further hypothesis was implicit in the selection of the 'E' and 'W' boroughs and it was thought that 'E', with its predominance of men in Class IV and Class V occupations, might as an area have higher inception rates than 'W', with its high proportion of men in Social Classes I and II.

The rates of first admission actually found among men in the age range 15–59 years support the hypothesis that there is a real "social class" gradient in the inception of mental illness. Within the 'E' boroughs the rise in first admission rates with the fall in social class was evident for manic depressive psychosis and for all diagnoses together; and within the 'W' boroughs there was an even clearer social class gradient for schizophrenia than for manic depressive psychosis, with a marked rise in rates for Class V. This gradient is similar to, though not as steep as, that for total admission rates shown in the Registrar General's report on mental health in 1950–51: for men aged 20 years and over, the three diagnoses investigated—schizophrenia, manic depressive psychosis, and psychoneuroses—together gave a total admission rate of 6·5 per 10,000 in Classes I–II rising to 17·5 in Class V. For schizophrenia alone, the total admission rate rose from 1·6 per 10,000 in Classes I–II to 8·0 in Class V. The similarity of these total admission rates reported by the Registrar General to the first admission rates found in 'E' and 'W' suggests that the steeper gradient in total admission rates reflected social class differences in re-admissions.

The further hypothesis that the class gradient would be reflected in higher first admission rates in the Class IV–V 'E' boroughs than in the well-to-do 'W' boroughs was to some extent confirmed for the psychoses of the elderly but has been clearly contradicted for the age range 15–59 years. 'W' had higher rates than 'E' for each diagnosis at ages 15–59 and particularly for schizophrenia, and the rates for schizophrenia among women in 'W' were markedly discrepant. Such discrepancies require explanation or at least interpretation. The data presented on certain characteristics of the 'E' and 'W' populations show that, in addition to "social class" differences, there are significant differences in a number of features usually considered pertinent to hospitalization for mental illness. 'E' and 'W' differ radically in age and sex composition, in marital state, in family and household structure, in number of persons living alone, and in place of origin of the population. With such deep dissimilarities between the two areas, occupational "class" composition is an over-simplified index which does not fully describe each population, and a simple comparison of area rates based only on occupational "class" may not give a true comparison of like with like. It is of interest to observe that, in his study of suicide in London, Sainsbury (1955) noted ten boroughs as having exceptionally high sucide rates, and considered features of social disorganization to be associated; among these ten boroughs are all five of the 'W' group investigated in the present study.

Another criticism of occupation as an index of social class must be considered. The "social class" of an occupation, in a population covering a wide range of occupations of many levels of skill, may be a meaningful index to discriminate between persons within that population. Yet within a community with a much narrower range of occupations of more uniform social status, the broad classification of occupations may have little discriminative power, and a different classification based on the local tradition and value system may be needed to differentiate between the "social classes" within that community. It may be that, in an area like 'E', the prestige and mode of life of the clerk set him as much apart from the casual labourer as the prestige and mode of life of the professional man in 'W' set him apart from the skilled manual worker. If this is so, a full understanding of the social class gradient in schizophrenia will depend on intensive studies of communities with their own traditions, values, and tolerance of mental illness rather than on national or regional data on heterogeneous populations and the selection of only one factor in the social complex.

Summary

First admissions to mental hospitals in the years 1954 and 1955 were studied for a group of West London boroughs and a group of East London boroughs, in order to investigate whether the "social class" gradient among mental hospital in-patients in England and Wales—particularly among schizophrenics—was due to higher inception rates or was

only a reflection of a higher prevalence in Social Class V. The West London boroughs were outstanding in the 1951 Census for their high proportions of enumerated men in Social Classes I and II, whereas the East London boroughs were outstanding for their high proportions of men in Social Classes IV and V.

The findings within both the 'E' boroughs and the 'W' boroughs among men aged 15–59 years indicate that there is a real "social class" gradient in the inception as well as in the prevalence of mental illness. Within the 'W' boroughs there was a particularly marked class gradient in first admission rates for schizophrenic disorders. Yet the apparently well-to-do 'W' area had higher rates of first admission of persons aged 15–59 than did the lower class 'E' boroughs, particularly for schizophrenic disorders and particularly among older women.

Data on other social and demographic factors which bear upon mental illness and hospitalization, such as household structure, marital state, and number of persons living alone, indicate that the 'W' boroughs differ radically from the 'E' boroughs, not only in "social class" but also in family life and in social and geographical stability. It is suggested that, when several important features differ so deeply between areas, comparison by the single index of "social class" is not meaningful; further, the use of occupation as an index of social class in areas of different status or different traditions is open to criticism.

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INCIDENCE OF NEUROSIS IN A NEW HOUSING ESTATE

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A housing estate built by the London County Council in Hertfordshire has provided the setting for a series of socio-medical investigations carried out by members of the Department of Public Health, London School of Hygiene and Tropical Medicine. Reports so far published include an analysis of general practitioner consultations (Brotherston and Chave, 1956), and a brief discussion of some social and psychological effects of rehousing (Maule and Martin, 1956). This paper presents an estimate of the incidence of mental illness among the population of the estate. In view of the estate's demographic structure one would be led to expect a relatively low rate of mental illness, since those groups with the highest risk of admission to mental hospitals—old people, unmarried adults, unskilled workers—form a small part of the estate population (Brotherston and Chave, 1956). On the other hand, it seemed plausible that the strains consequent on rehousing in a new estate of suburban character, combined with the preponderance of small families unsupported by extended kinship ties, might predispose to an increased incidence of at any rate the minor psycho-neurotic and psycho-somatic disorders. We were also aware of the fact that, in an appreciable proportion of rehoused families, some degree of priority for rehousing had been allowed because of illness in one or another member of the family, with neurotic illness ranking fairly high among the conditions concerned, and we were interested to know how far this might have increased the need for psychiatric or quasi-psychiatric care. We were not in a position to undertake a direct screening of a representative sample of the estate population, and in the circumstances decided to obtain a number of simpler and necessarily more superficial indices of the incidence of mental illness. Three of these relate to the use of medical services and the fourth is based on self-assessment:

(1) Admissions to mental hospital in the period 1949–1954.

(2) Referrals to psychiatric Out-Patient Clinics in the period 1952–1954.

(3) General practitioner consultations associated with psychiatric or psycho-somatic diagnoses during 1953.

(4) Complaints of "nerves", "depression", etc., reported in the course of a direct interview survey carried out in 1954–1955.

Mental Hospital Admissions

Records of the admission of certified and voluntary patients to the mental hospitals serving the area are available from the beginning of 1949, that is to say, from about one year after the building of the estate was begun. From then until the end of 1954 there were 129 admissions of patients from addresses on the estate. Table I (opposite) shows the distribution of these cases year by year and relates them to the estimated population of the estate.

During the period when the estate was in course of construction the size of the population at risk was constantly changing. The figures given in Table I are mid-year estimates based on the records of the London County Council's Housing Department and checked where possible by reference to other sources, such as the 1951 Census and the results of our own field enquiries in 1953–55. There is no doubt that the overwhelming majority of cases needing in-patient psychiatric treatment were received at a single hospital in Hertfordshire, but we cannot, of course, preclude the possibility of admissions, especially of voluntary patients, to other hospitals, although there is every reason to suppose that such admissions must have been extremely rare. In any

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event it is probably safest to regard the admission rates shown in Table I as minimum estimates.

TABLE I

MENTAL HOSPITAL ADMISSIONS, 1949–1954

Year	Estimated Population	Actual Admissions	Rate per 1,000	"Expected" Admissions	"Expected" Rate per 1,000	Ratio of Actual to "Expected"
1949	4,987	8	1·60	4·60	0·92	1·74:1
1950	8,814	10	1·13	8·11	0·92	1·23:1
1951	14,639	20	1·37	14·28	0·975	1·40:1
1952	16,909	25	1·48	17·29	1·02	1·44:1
1953	17,256	33	1·91	19·10	1·11	1·72:1
1954	17,506	33	1·89	*	*	*

* Information not available

We have used the reports of the Registrar General based on records maintained in all mental hospitals in England and Wales to calculate "expected" admission rates for the estate for the years 1949, 1950, and 1951 (Registrar General, 1953, 1955) and have drawn on the preliminary calculations of national admission rates—as yet unpublished—for 1952 and 1953. The national age- and sex-specific mental hospital admission rates for each of the 5 years were applied to the estate population figures for the corresponding year. As Table I shows, the actual admission rate was from 23 to 74 per cent. in excess of the expected rate in each of the 5 years, and over the whole period the actual number of admissions was in excess of the expected number by slightly more than 50 per cent. The use of Greater London mental hospital admission rates as a standard, rather than the rates for the country as a whole, does not materially affect this conclusion.

Table II shows that the greater part of the excess is located in a particular age/sex group. In Table II we have tried to estimate the average annual age- and sex-specific admission rates for the estate over the whole period. In all the adult groups the rates are higher than would be expected on the national basis, but the discrepancy is more marked among those aged 55+ and most strikingly marked among women aged 45+. Middle-aged and elderly people account for only a very small proportion of the estate population, but for an entirely disproportionate number of mental hospital admissions. Not too much weight can be attached to this Table alone, since the estimates of the size of the age groups are based on the assumption that the age structure of the estate has remained constant throughout its growth. If this were untenable and the majority of people of middle age and above had settled on the estate in its earliest days, their degree of exposure to risk would have been higher and the increased average admission rates shown in this Table might be no more than a reflection of this. An essentially similar pattern emerges, however, when we calculate admission rates for those single years of the estate's history in which the age distribution is known. Females aged 45 and above account for 55 per cent. of all female admissions during the 6 year period. This corresponds fairly closely with their proportionate representation among all female admissions to mental hospital in England and Wales. But whereas this age group makes up 37 per cent. of the total female population in the country it accounts for only 13 per cent. of all females living on the estate.

TABLE II

AVERAGE ANNUAL MENTAL HOSPITAL ADMISSION RATES, 1949–1954

Age Group	Average Size of Age Group		Total Admissions		Average Annual Admission Rate per 1,000		National Admission Rate per 1,000 1951	
	Male	Female	Male	Female	Male	Female	Male	Female
0–15	2,714	2,806	3	1	0·18	0·06	0·06	0·04
16–19	328	394	2	—	1·00	0·00	0·68	0·73
20–24	226	429	2	4	1·46	1·56	1·36	1·26
25–34	1,110	1,269	15	18	2·25	2·36	1·64	1·72
35–44	1,191	1,122	17	11	2·38	1·63	1·32	1·91
45–54	520	469	6	18	1·92	6·40	1·37	2·14
55–64	157	177	4	11	4·27	10·34	1·71	2·22
65+	186	254	5	12	4·46	7·87	2·31	2·69
Total	6,432	6,920	54	75	1·40	1·81	1·16	1·53

The distribution of diagnoses among estate admissions (Table III, overleaf) differs significantly from the national pattern, with psychoses making up a smaller proportion of the total in both sexes.

In 1951, for example, just under 16 per cent. of all admissions to mental hospitals in England and Wales carried a diagnosis of psychoneurosis, while among the estate patients the proportion was twice as high. If the distribution as between psychoses, psychoneuroses, and other diagnoses is compared with the distribution found in national admission statistics, the difference is significant for both sexes ($P<0{\cdot}01$) and is most marked for females. The striking feature of Table III is, of course, the large number of female cases admitted with diagnoses of neurotic depressive reaction. These outnumber the males in the ratio of 3·5 : 1 as compared with the national ratio of 1·7 : 1. That only a low proportion of the admissions were chronically ill is indicated by the high discharge rate and the short duration of hospitalization among those discharged. Of the 129 patients in question, six died in hospital and fifteen were still resident when the records were examined in

mid-1955. The remaining 108 had left hospital and 76 of them (70 per cent.) had left within 3 months of admission.

TABLE III
DIAGNOSES ON ADMISSION: MENTAL HOSPITAL ADMISSIONS, 1949–1954

Diagnosis		No. of Cases					
		Male		Female		Total	
		No.	Per cent.	No.	Per cent.	No.	Per cent.
Psychosis	Schizophrenia	14		17		31	
	Manic-depressive Reaction	12		13		25	
	Senile Psychosis	1		5		6	
	All Other Psychoses	6		8		14	
	All Psychoses	33	(61)	43	(57)	76	(59)
Psycho-neurosis	Anxiety Reaction	5		4		9	
	Neurotic Depressive Reaction	6		21		27	
	Other Psychoneuroses	5		1		6	
	All Psychoneuroses	16	(30)	26	(35)	42	(32)
Behaviour, Character, and Intelligence Disorders		4	(7)	6	(8)	10	(8)
Other		1	(2)	—		1	(1)
Total		54		75		129	

REFERRALS TO PSYCHIATRIC OUT-PATIENT CLINICS

Referrals to psychiatric out-patient clinics are dealt with very briefly, partly because our records are unlikely to be complete, and partly because of the difficulty of finding an adequate comparison group. The available records, relating to referrals to local out-patient clinics from 1952 to 1954 inclusive, show that 133 new cases were referred from the area. The annual distribution of these cases and the corresponding referral rates per 1,000 population are shown in Table IV.

TABLE IV
PSYCHIATRIC OUT-PATIENT REFERRALS, 1952–1954

Year	Estimated Population	No. of Referrals	Rate per 1,000
1952	16,909	42	2·5
1953	17,256	50	2·9
1954	17,506	41	2·3

It seems quite likely, however, that some patients may have been referred to out-patient clinics at other hospitals, especially at the London teaching hospitals; no complete record of these is available though the number was probably not very great. The annual reports of the Ministry of Health show that, for the years in question, between 100,000 and 120,000 new cases were referred each year to psychiatric out-patient clinics in England and Wales, referral rates (per 1,000 population) being 2·5 in 1952 and 1953 and 2·7 in 1954. On the face of it these figures are very similar to the estate referral rates, but we do not know to what extent the latter rates are underestimated, nor are we in a position to standardize the rates so as to make allowance for the distinctive age structure of the estate population. The estate's use of psychiatric services was about twice as high as that of the neighbouring areas served by the same hospitals, but no great weight can be attached to this. One might anticipate that the use of hospitals outside the immediate locality would be at least as frequent among the residents of nearby districts as among people living on the estate, and in the case of psychiatric problems it may well be a good deal more common.

GENERAL PRACTITIONER CONSULTATIONS

During 1953 all the doctors in general practice on the estate maintained records of all their consultations. Details of the system of records and of the method of analysis were given by Brotherston and Chave (1956). In this section we present some of the material extracted from an analysis of the records relating to a one in four sample of families. The diagnoses listed in Table V (opposite) fall into three main categories: the psychoses and psycho-neuroses; a group of physical conditions whose aetiology is usually believed to include a substantial psychological component (this list is necessarily selective and does not include all the disorders which have at one time or another been classified as psycho-somatic); and a number of symptomatic and ill-defined conditions in which a psychological element seems often to be implicated. An attempt is made in Table V to compare the frequency of these conditions in the estate population with a national standard. Since general practitioners' records based on a random or representative sample are not available, the standard must necessarily be imperfect. We have used what we believe to be the best approximation to the experience of the general population, namely that represented by the averages of the practices studied by Logan (1953, 1955) over a period of 3 years.

The averages for the general population shown in Table V are based upon the experience of 26 practice-years. A direct comparison with the estate population is of limited value, since the two populations differ in their age structure. We have therefore applied age- and sex-specific consultation rates prepared by

TABLE V

GENERAL PRACTITIONER CONSULTATIONS RELATED TO CERTAIN DIAGNOSES: ACTUAL AND "EXPECTED" RATES

No. in International Classification	Diagnosis	No. of Patients Consulting per 1,000 Registered Population		
		Estate Population		General Population†
		Actual	Expected*	
300–309	Psychosis	3·0	1·0	1·5
310	Anxiety Neurosis	23·4	11·8	14·9
311	Hysterical Neurosis	1·6	1·4	1·6
318·3	Neurasthenia	13·2	10·3	12·2
318·5	Psychoneurosis N.O.S.	11·3	10·6	13·7
312–317, 318·0, ·1, ·2, ·4	Other Neuroses	6·8	5·4	6·9
325	Mental Deficiency	0·3	1·1	0·9
322	Alcoholism	—	0·2	0·3
320, 321–324, 326	Personality Disorders	2·7	3·8	2·6
240	Hay Fever	6·5	4·6	4·6
243	Urticaria and Allergic Rash	24·8	19·5	14·9
354	Migraine	8·6	6·2	6·9
420·1	Coronary Disease	1·1	1·4	3·2
444	Hypertension	6·5	6·8	15·3
540	Gastric Ulcer	4·6	4·4	6·2
541	Duodenal Ulcer	10·2	3·9	5·2
544	Dyspepsia	18·1	18·9	23·5
241	Asthma	12·1	7·6	8·4
780·6	Vertigo	5·4	3·3	4·5
780·7	Disturbances of Sleep	25·6	6·3	9·4
782·1	Palpitations	1·1	0·2	0·3
784·0	Anorexia	9·7	2·1	1·9
786·2	Incontinence of Urine	4·0	2·7	2·0
790·0	Nervousness	3·2	0·9	0·8
790·1	Debility and Undue Fatigue	50·9	13·3	13·2
790·2	"Depressed", Depression	7·0	3·3	4·6
791	Headache	29·6	10·0	11·1

* If rates were the same as for the general population (see text)
† Derived from the Report of the Registrar General for England and Wales (1953, 1955).

Logan for the Registrar General to the estate population to give the expected number of patients consulting. The estate consultation rate exceeds the expected figure for psychoses, for all the neuroses, for most of the psycho-somatic disorders, and for all the symptomatic conditions. The exceptions are mental deficiency, alcoholism, personality disorders, coronary disease, hypertension, and dyspepsia. There is, however, a wide variation between the practices studied by Logan, and we assume that some part of this variation must be due to differences in diagnostic practice as well as to true differences in the incidence of illness in the different areas. We have therefore calculated the number of practice-years in which the rates recorded for each of these conditions in the general population exceeds the estate rate. For three conditions (anorexia, debility, and headache) consultation rates in the estate practice are higher than any recorded for the general population, and for four other conditions, including duodenal ulcer, they are higher than all but one.

Table VI shows the trend with age of the consultation rate for psychoses and psychoneuroses separately for males and females. The consultation rate for females is higher than that for males in all but the youngest age groups. An interesting feature of Table VI is the decline in the consultation rate for women in the oldest age group as contrasted with a further increase among men. A similar pattern is evident when general practitioner consultations for all conditions are considered, and possible explanations were discussed in the earlier paper. We are also reminded that the mental hospital admission rate for women on the estate also falls away in the oldest age group while that for men continues to rise. There can be no doubt that the small number of old people living on the estate are altogether unrepresentative of their age and sex groups for the wider population.

TABLE VI

GENERAL PRACTITIONER CONSULTATIONS RELATED TO DIAGNOSES OF PSYCHOSIS AND PSYCHONEUROSIS

Age Group (yrs)	No. in Sample (average registered population)		No. of Patients Consulting per 1,000 Average Registered Population	
	Male	Female	Male	Female
Under 20	842	880	13·1	11·4
20–24	59	112	17·0	80·4
25–34	317	357	53·6	140·1
35–44	328	324	64·0	123·6
45–54	147	130	40·8	154·0
55–64	44	50	45·5	180·0
65+	51	69	78·5	86·9
All Ages	1,788	1,922	34·7	74·9

For some of the other diagnostic categories numbers are too small to justify a combined analysis of incidence by age and sex. Table VII (overleaf), however, shows male and female consultation rates for all but the smallest diagnostic groups. With the exception of peptic ulcer, which is not commonly found among women, and dyspepsia, which has a slight male excess, the female consultation rate is higher for every condition.

SELF-REPORTED SYMPTOMS

Between May, 1954, and February, 1955, a Family Health Survey was carried out on the estate. A sample of about 750 families was selected and their members invited to volunteer information about their own health, their use of the health services, and some general social characteristics. Each adult was

TABLE VII

GENERAL PRACTITIONER CONSULTATIONS FOR SELECTED CONDITIONS, BY SEX

Diagnosis	No. of Patients Consulting per 1,000 Average Registered Population	
	Males	Females
Anxiety Neurosis	13·4	32·8
Neurasthenia	6·2	19·8
Psychoneurosis N.O.S.	8·9	13·5
Other Psychoses and Neuroses	6·2	8·3
Hay Fever	5·0	7·8
Urticaria and Allergic Rash	22·9	26·5
Migraine	5·0	12·0
Hypertension	3·4	7·8
Gastric Ulcer	7·3	2·1
Duodenal Ulcer	16·8	4·2
Dyspepsia	21·3	15·1
Vertigo	4·5	6·2
Disturbance of Sleep	17·9	32·8
Anorexia	7·8	11·4
Debility	31·3	69·2
Depression	2·8	10·9
Headache	16·2	42·1

interviewed individually on at least two occasions and in the course of the first interview was presented with a check-list of forty symptoms (41 for women) and asked whether he was troubled by or subject to any of them. We consider here those symptoms which are especially relevant in the present context, namely depression, "nerves", sleeplessness, and undue irritability. 22 per cent. of all the adult subjects claimed that they were troubled by "nerves", and 17 per cent. by depression; 12 per cent, complained of sleeplessness, and almost as many of undue irritability. These percentages are not additive, since many complained of two or more of these symptoms. The total number reporting at least one of the four symptoms amounts to 35 per cent. of the entire sample; one-quarter of the men and more than two-fifths of the women fall into this category.

The distribution of these complaints in relation to the age and sex composition of the sample studied is shown in Table VIII. For three of the four symptoms the female incidence is about twice as high as the male incidence. The sexes differ, however, not only in frequency of complaint but also in their patterns of age incidence. On the whole the male pattern is less clearly defined. Among the men there is a relatively high level of complaint in the age group 20–24, although the numbers here are small, and then there is a falling off between the ages of 25 and 44; after 45 there is a rise, but not a very steep one. Complaints of "nerves" are most frequent among men in the age group 65+; this trend is not found in the incidence of depression or undue irritability. Complaints of sleeplessness in the oldest age group are no more common than among young men aged between 20 and 24. In general, the degree of variation associated with age is not very great among men. Among the women, however, the frequency of complaint of each of these symptoms increases almost without exception with age, until age 64, after which there is a marked decline. There is also for each symptom a different point on the age scale at which the incidence of complaint rises with particular steepness. Thus the incidence of both "nerves" and undue irritability is at least doubled after the age of 24; the major increase in the incidence of depression is 10 years later; complaints of sleeplessness rise steeply in the mid-forties. In spite of these variations, the symptoms have two features in common, an excess of female complainants and a lower incidence among women aged 65+ than in the age group just below it, which reflect the pattern that we have already seen in both mental hospital admissions and general practitioner consultations for psychoneurotic illness.

Since we are not aware of any other inquiry directly comparable with our Family Health Survey in scope and method, it is difficult to find an adequate standard by which to judge whether the frequency of these symptoms is exceptionally high. Probably the

TABLE VIII

FREQUENCY OF CERTAIN SYMPTOMS IN A FAMILY HEALTH SURVEY

Age Group (yrs)	No. in Sample		Percentage Complaining of:							
			Depression		"Nerves"		Sleeplessness		Irritability	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Under 20	60	85	8	9	15	12	0	0	7	4
20–24	42	51	12	18	19	12	12	8	12	8
25–34	185	229	10	19	13	30	6	12	10	16
35–44	243	231	9	30	14	35	7	14	10	13
45–54	112	102	13	32	18	29	10	31	13	15
55–64	27	37	15	38	15	41	7	38	0	16
65 and Over	33	48	12	19	24	27	12	31	3	6
All Ages	702	783	10	24	15	29	7	16	10	12

nearest approach to an adequate control can be found in the work of the officially-sponsored Survey of Sickness, carried out on a nation-wide basis by the Ministry (later Central Office) of Information at regular intervals over a number of years. Stocks (1949) gives a prevalence rate for psychoneuroses of 126 per 1,000 population. Survey of Sickness returns are based entirely on self-reported conditions, and this particular figure, so far as can be judged, indicates the number of persons complaining of "nerves" and possibly some other symptoms. Probably the most conservative comparison would be between Stocks's prevalence rate and the frequency with which complaints of "nerves" are reported in our Family Health Survey. Our estimate (223 per 1,000 adult population) is 77 per cent. in excess of the national rate. The comparison is not entirely satisfactory, since no allowance is made for differences in age structure. In view of the relative youth of the estate population a rate significantly below the national level would be expected. We may assume, therefore, that the true difference is if anything minimized by the present comparison.

The men and women on the estate who complain of symptoms suggestive of some degree of psychoneurotic impairment can be shown to differ in many respects, both medical and social, from their neighbours who report other or no symptoms. Most of these differences, however, are not relevant to a discussion of incidence, with one exception which is of particular interest in this context. Table IX shows the relationship between the frequency with which these symptoms are reported and the length of time the men and women concerned had been living on the estate. Complaints were most numerous among those who had come to live on the housing estate during the year or two preceding the survey. For the other two groups—those rehoused 3–4 years or 5–6 years before—the frequencies were exactly or almost exactly the same. The possible significance of this finding is discussed in the following section.

TABLE IX

INCIDENCE OF CERTAIN SYMPTOMS IN RELATION TO DURATION OF RESIDENCE ON THE HOUSING ESTATE

Year Rehoused	No. in Sample	Percentage Complaining of:			
		Depression	"Nerves"	Sleeplessness	Undue Irritability
1948–49	538	16	21	12	11
1950–51	730	16	23	11	11
1952–54	219	23	25	15	15

DISCUSSION

It may well be impossible to establish a single criterion by which the mental health of an individual may be assessed, and the mental health of a community certainly cannot be measured by any absolute standard. While, therefore, we appreciate that our indices of mental ill-health are necessarily crude, it does not seem unreasonable to believe that, by bringing a number of such indices together, we may obtain an approximate assessment of the mental health status of the community with which we are concerned. Of the four measures examined, three suggested that mental health problems are significantly more common on the estate than might be expected on demographic grounds. The rate of referral to psychiatric out-patient clinics corresponds quite closely with the national average, but the likelihood of our records being incomplete, combined with the existence of substantial local differences in facilities and in referral practices, make it impossible for us to say more than that the referral rate is not lower than the national average.

The characteristics of the rehoused population do not seem to provide an adequate explanation for the apparent excess of psychological disorder among people on the estate. It is true that mental and nervous illness ranks high in the list of medical conditions for which housing priority was given, but only a small proportion of the population is affected. A medical certificate with a psychiatric or quasi-psychiatric diagnosis was submitted in support of an application for rehousing, for only 2 per cent. of the adult males and 8 per cent. of the adult females. Even if we consider these figures as representing net additions to a population group in which mental and nervous disorders are otherwise normally distributed they account for only a small part of the excess incidence. It seems likely that the effects of rehousing and the conditions of life on the estate must be held responsible for the greater part of the relatively high level of neurosis.

There seem to be two principal groups of factors involved. We have first to consider the dislocating effects of the rehousing process itself, with all that it requires in the way of modification of personal and family life. The adaptation of families rehoused from overcrowded conditions in Paddington, North Kensington, and Fulham, to life on an estate of suburban character in semi-rural surroundings must necessarily be a gradual process. We know from other evidence gathered on the estate that rehousing affects very many aspects of family life. Patterns of expenditure, of employment, of leisure activities, and of relations with neighbours, kinsfolk, and friends,

are all substantially modified. We might confidently predict, on the basis of established knowledge of the effects of social and cultural change, that the process of adaptation would be accompanied by an increase in the incidence of minor psychoneurotic and psychosomatic disorders. But we must also remember that the long-term conditions of life on the estate, with its attenuation of ties of kinship and with each family "keeping itself to itself",* may generate a degree of loneliness and social isolation inconsistent with positive mental health. The relative weight to be attached to each of these two groups of factors will depend to some extent on trends over time; a decline in the incidence of neurosis will tend to incriminate the short-term effects of rehousing as the principal factor.

An analysis of the statistics of juvenile delinquency and of the use of the child guidance services, not included in the present report, has suggested that psychological maladjustment was exceptionally common among children on the estate immediately after rehousing, but that a large measure of stabilization later occurred. Any similar trends in adults might be expected to become apparent more slowly. The mental hospital admissions do not show any consistent downward trend—though we do not yet know what an investigation over a more extended period might reveal—and our other sources of information cover only a limited period. We can, however, consider the symptoms reported in the Family Health Survey in relation to the duration of our informants' residence on the housing estate, and such an analysis points clearly to a maximum incidence of psychoneurotic symptoms among those most recently rehoused. There are therefore some grounds for anticipating a gradual improvement in the mental health status of the community.

We are aware that in this study we can merely point to certain possible connexions between the incidence of neurosis on the estate and some of the social characteristics of the community; we cannot rigorously demonstrate a causal relationship. In this type of investigation the unit of study is in a sense the entire community, and in that sense we have only a single case. From that point of view we should welcome comparable studies of other communities, and especially of housing estates, New Towns, and extended towns. Studies of mental health problems in New Towns, whose principle of social development is substantially different from that of housing estates, would be especially illuminating.

* A recently published study of another L.C.C. housing estate provides a perceptive analysis of this problem (Young and Willmott, 1957).

SUMMARY

A relatively high incidence of psychological disorder in the population of a new housing estate is indicated by an analysis of the use of general practitioner and psychiatric out-patient services, mental hospital admissions, and the results of a personal interview survey. It is suggested that this high incidence may be attributable in part to the effects of rehousing and to the conditions of social life on the estate. There are, however, some indications of a gradual amelioration with time.

We are deeply indebted to Dr. J. H. Patterson, Physician Superintendent of Napsbury Hospital, for permission to study his records, to the general practitioners of the estate for their assiduous record-keeping, to Miss Ann Cartwright for her work in connexion with the Family Health Survey, to Miss Jane Cooper for her work on the analysis of the records, to Miss E. M. Brooke of the General Register Office for very kindly supplying in advance of publication the statistics of mental hospital admissions for 1952 and 1953, and to Prof. J. M. Mackintosh for his constant encouragement of the project of which this report forms part.

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RELATION BETWEEN MATERNAL AGE AT PARTURITION AND INCIDENCE OF MENTAL DISORDER IN THE OFFSPRING

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It has been shown that the incidence of mongolism increases with advancing maternal age at the birth of the affected child (Penrose, 1939, 1954; Smith and Record, 1955), and it has been suggested that there may be a similar association for other mental disorders (Penrose, 1953). This view is based mainly on data published by the General Register Office relating to persons admitted to N.H.S. mental hospitals in England and Wales in the years 1949 and 1950 (Registrar General, 1953, 1955).

The maternal age distribution at the birth of these patients was compared with that for all births (derived from birth registrations for persons born since 1936 and from estimates published by the General Register Office for older persons). Conclusions based upon these data may be open to doubt, however, because maternal age was not known for a large proportion of mental hospital admissions (55 per cent.) and because the figures relate to admissions and not to patients: frequency of admission to hospital depends to some extent on home conditions and may, therefore, be influenced by the mother's age and ability to manage.

There have been several inquiries in related fields. Heron (1907) studied the association of birth order and incidence of mental disease, but his method was criticized independently by Greenwood and Yule (1914) and by Weinberg (1913). Malzberg (1940) included birth order in his study of first admissions to Manhattan State Hospital during 1930–1935. Norton (1952) compared 500 patients attending the psychiatric outpatient department of a general hospital (*excluding* those with frank psychoses) with 500 general in-patients matched for age, sex, and social class; although his main object was to study the association between birth order and incidence of mental disorder, he included a record of the maternal age at the birth of patients in both series. He found the proportion of mothers over age 35 to be higher and the proportion of mothers under age 25 to be lower in the neurotic group than in the controls, but the differences were not statistically significant.

The purpose of the present investigation was to discover whether the age-distribution of mothers at the time of the birth of children who later became mentally disturbed differs from that of all mothers, and if so to explore the possible influence of some of the social and family circumstances of the psychotic patients.

METHOD

Records of patients admitted to the Bethlem Royal Hospital and the Maudsley Hospital during 1949-1954 were first examined. As this is a joint teaching hospital with only voluntary admissions, the patients were not representative of all mental patients. Moreover, for more than a quarter of the patients under 55 years of age, the mother's age at birth of the patient had not been recorded, nor was it possible retrospectively to obtain this information or to discover why it was lacking. In spite of these drawbacks, however, analysis of the data suggested that further inquiry might be useful.

The next step was to study patients admitted to an observation ward of eighty beds in South-East London, where the following information was collected by psychiatric social workers:

Present age of parents, or age and year of death.
Number of children born to the mother.
Position in family of patient.
Marital status of patient.
Occupation of patient and patient's father.
Diagnosis and disposal from observation ward.

The next group investigated consisted of patients at a mental hospital in South London. It has over 2,000 beds and two out-patient clinics attached to general hospitals and serves a diverse area north of the Thames extending from Notting Hill and North Kensington in the east to Twickenham in the west. The main sources of data were the psychiatric social worker's records obtained from the patient and the relatives, and a routine form filled in by the relatives.

For comparison the Registrar General's figures for all births were used (Civil Text, 1946–50, pubd. 1954); for births before 1938, when this information was first recorded, these figures are given as estimates in 5-year periods. The maternal age distribution for

*Medical Research Council Research Fellow.

TABLE I

PERCENTAGE DISTRIBUTION OF FEMALE LIVE BIRTHS IN ENGLAND AND WALES ACCORDING TO AGE OF MOTHER

Age of Mother at Birth of Child (yrs)	Quinquennium							
	1901–05	1906–10	1911–15	1916–20	1921–25	1926–30	1931–35	1936–40
15–	2·3	2·2	2·4	3·0	2·8	3·0	3·5	4·1
20–	20·7	20·1	20·6	22·6	23·4	23·5	23·7	23·6
25–	30·6	30·8	30·7	30·6	31·3	32·2	32·5	32·5
30–	24·3	25·0	25·1	24·1	23·6	23·9	23·5	23·1
35–	15·8	15·9	15·5	14·6	14·1	13·0	12·7	12·5
40 and Over	6·4	6·0	5·7	5·2	4·9	4·3	4·2	4·3

(Adapted from Registrar General's Civil text 1946-50, Appendix 3, Table 3)

births in the whole population is younger in recent years, but since 1900 the proportion of mothers aged 35 years and over at the birth of the patient has ranged only from 22 per cent. at the beginning of the century to 17 per cent. at the end of the period* (Table I).

Patients of foreign nationality, except for those from Eire, were excluded. The upper age limit of patients was 55 years for the observation ward and 50 for the mental hospital.

RESULTS

Data relating to 241 patients in the observation ward and 441 in the mental hospital were obtained. Diagnoses are shown in Table II. In the first part of the analysis here reported, all diagnoses have been considered together, but the more detailed examination which follows is based on the schizophrenic patients which form a large part of the total series.

TABLE II

CLASSIFICATION OF PATIENTS

Diagnosis	Observation Ward				Mental Hospital			
	Males		Females		Males		Females	
	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.
Schizophrenia Mixed Psychoses	47	46	48	35	111 1	63	138 7	55
Depression Involutional Depression Neurotic Depression	20	19	59	43	19 – 10	17	25 8 40	27
Psychopathy and Neurosis Alcoholism	23	22	14	10	19 6	14	34 –	13
Organic Disorders ..	13	13	17	12	9	5	14	5
Total ..	103		138		175		266	

*The Registrar General's figures are primarily for use in population studies and so are for live *female* births. A comparison between male and female births for the second 6 months of 1938 shows little difference between mother's age for live female and live male births; in none of the maternal age groups was the difference more than 0·1 per cent.

MOTHER'S AGE AT PARTURITION

(*a*) *All Diagnoses.*—Since maternal age in the whole population has changed slightly over the century, the expected distribution for comparison with the observed ages of mothers at the birth of patients, was obtained by combining the births in separate 5-year periods given by the Registrar General in the same proportion as the group of patients.

All four groups of patients had a smaller than expected proportion of mothers who were under the age of 25 when the patient was born, and all had a larger than expected proportion of mothers aged 35 and over (Table III and Fig. 1, opposite).

TABLE III

DISTRIBUTION ACCORDING TO MATERNAL AGE AT BIRTH OF PATIENT (ALL DIAGNOSES)

Sex	Maternal Age at Birth of Child (yrs)	Observation Ward		Mental Hospital	
		Observed Number	Expected* Number	Observed Number	Expected* Number
Male	Under 20	3	2·7	4	4·2
	20–24	16	21·3	22	32·5
	25–29	19	30·0	40	45·4
	30–34	33	23·2	48	35·0
	35–39	17	13·8	23	20·6
	40 and Over	8	5·0	8	7·3
	Total	96	96·0	145	145·0
	Not Known	7		30	
Female	Under 20	3	3·4	0	0·0
	20–24	21	27·8	28	44·3
	25–29	41	39·3	50	62·7
	30–34	30	30·5	60	48·9
	35–39	21	18·4	41	29·1
	40 and Over	10	6·7	22	10·4
	Total	126	126·1	201	201·0
	Not Known	12		65	

*The expected number is based on the maternal age distributions of all persons born in the same years as the patients

SIGNIFICANCE

Observation Ward	Males	$\chi^2 = 11{\cdot}75$; 4 d.f.; $0{\cdot}025 > P > 0{\cdot}001$
	Females	$\chi^2 = 3{\cdot}5$; 4 d.f.; $0{\cdot}5 > P > 0{\cdot}3$
Mental Hospital	Males	$\chi^2 = 8{\cdot}7$; 4 d.f.; $0{\cdot}1 > P > 0{\cdot}05$
	Females	$\chi^2 = 32{\cdot}2$; 4 d.f.; $P < 0{\cdot}001$

(Two youngest age groups taken together)

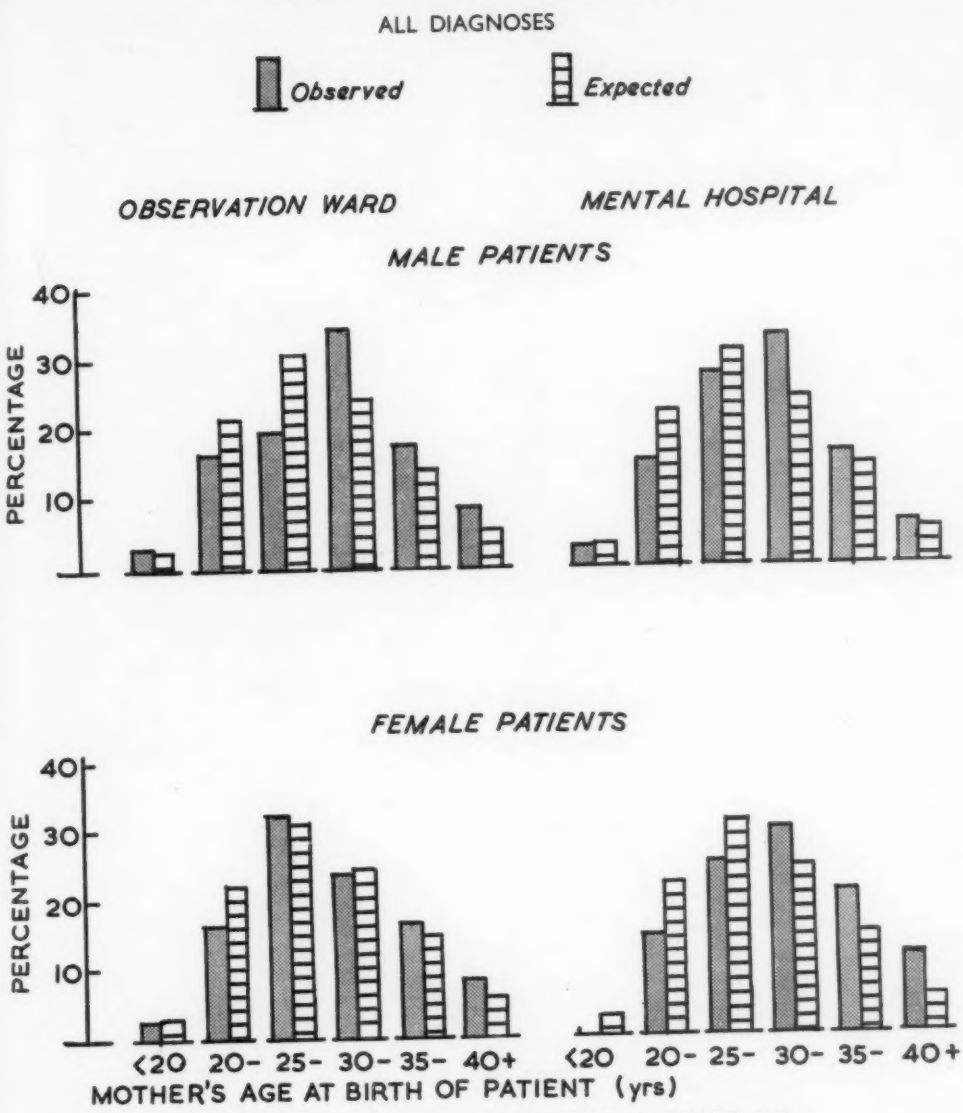

FIG. 1.—Percentage distribution according to maternal age at birth of patient (all diagnoses)

The "peak" age of mothers for all births was in the 25–29 age group, but for the patients, except for the women in the observation ward, the "peak" was in the 30–34 age group. The observation ward figures are based on small numbers and so are of limited reliability, the distribution for women not being significantly different from expectation. Both the mental hospital groups are based on larger numbers and the difference between the observed and expected distribution for the women is highly

significant ($\chi^2 = 32{\cdot}2$; 4 d.f.; $P < 0{\cdot}001$), but for the men it is not significant ($\chi^2 = 8{\cdot}7$; 4 d.f.; $0{\cdot}1 > P > 0{\cdot}05$). The main contribution to these results comes from the difference between the actual and expected numbers in the 30–34 maternal age group, which is significant for the women ($P = 0{\cdot}01$) and suggestive for the men ($P = 0{\cdot}05$).

(*b*) *Schizophrenia.*—All four groups of patients had a smaller than expected proportion of mothers who were under 25 when the patient was born, and all except the men in the mental hospital had a larger than expected proportion of mothers of age 35 and over (Table IV and Fig. 2, opposite).

TABLE IV

DISTRIBUTION ACCORDING TO MATERNAL AGE AT BIRTH OF SCHIZOPHRENIC PATIENTS

Sex	Maternal Age at Birth of Child (yrs)	Observation Ward		Mental Hospital	
		Observed Number	Expected Number	Observed Number	Expected Number
Male	Under 20	1	1·2	1	3·0
	20–24	4	9·6	18	22·5
	25–29	9	13·5	27	31·2
	30–34	15	10·4	38	23·7
	35–39	10	6·1	12	13·8
	40 and Over	4	2·2	3	4·8
	Total	43	43·0	99	99·0
	Not Known	4		13	
Female	Under 20	0	1·2	0	3·1
	20–24	10	9·7	13	25·0
	25–29	13	13·4	29	34·9
	30–34	9	10·4	41	27·1
	35–39	10	6·1	18	16·2
	40 and Over	1	2·2	11	5·7
	Total	43	43·0	112	112·0
	Not Known	5		33	

SIGNIFICANCE

Observation Ward	Males	$\chi^2 = 10{\cdot}8$; 3 d.f.; $0{\cdot}02 > P > 0{\cdot}01$
	Females	$\chi^2 = 1{\cdot}3$; 3 d.f.; $0{\cdot}3 > P > 0{\cdot}2$
Mental Hospital	Males	$\chi^2 = 11{\cdot}5$; 4 d.f.; $0{\cdot}025 > P > 0{\cdot}02$
	Females	$\chi^2 = 21{\cdot}3$; 4 d.f.; $P < 0{\cdot}001$

(Two youngest age groups and, for the Observation Ward only, the two oldest age groups combined)

The "peak" age of mothers of patients was again in the 30–34 age group, except for the women in the observation ward. The maternal age distribution for the men in the observation ward differs from expectation ($\chi^2 = 10{\cdot}8$; 3 d.f.; $0{\cdot}02 > P > 0{\cdot}01$); that for the women in the observation ward does not ($\chi^2 = 1{\cdot}3$; 3 d.f.; $0{\cdot}3 > P > 0{\cdot}2$). For the mental hospital groups, the difference between the observed and expected distribution is significant for the men ($\chi^2 = 11{\cdot}5$; 4 d.f.; $0{\cdot}025 > P > 0{\cdot}02$) and for the women ($\chi^2 = 21{\cdot}3$; 4 d.f.; $P < 0{\cdot}001$). Again, the main contribution to these results comes from the difference between the actual and expected numbers in the 30–34 maternal age group, which is significant for both men and women ($P = 0{\cdot}005$).

The thirteen men and the 33 women in the mental hospital for whom information on maternal age was not available were examined further to see if their exclusion was likely to bias the distributions of maternal age. Reasons for failure to obtain the information were examined. There were six illegitimate women who may have been first children or may have had young mothers; there is no other obvious reason for thinking that an undue proportion of either old or young mothers were among those whose ages were unknown.

The Registrar General's data for all births are based on information actually recorded at the time of birth; the hospital data were obtained from what the patient or relative could remember about the mother's age except in those cases where the informant was the mother herself. The information, therefore, might not always have been accurate. The Registrar General's figures and the hospital data differ also in that the hospital patients came mainly from South-East or West London, where the maternal-age distribution might be different from that of the country as a whole, even though there were only trivial differences between Greater London and the rest of the country. (In London there was 1 per cent. less in each of the two youngest age groups of mothers and in the two oldest groups combined, and 3 per cent. more in the middle groups.)

These two possibilities were investigated by asking patients in two general hospitals in South-East London for details of their mother's age. The maternal ages agreed with the distribution for the

TABLE V

DISTRIBUTION ACCORDING TO MATERNAL AGE AT BIRTH OF PATIENTS IN TWO GENERAL HOSPITALS IN S.E. LONDON

Maternal Age at Birth of Child (yrs)	Males		Females	
	Observed Number	Expected Number	Observed Number	Expected Number
Under 20	7	2·3	10	5·4
20–24	18	19·6	48	41·9
25–29	22	25·2	51	59·0
30–34	20	19·6	40	44·9
35–39	7	11·9	27	26·4
40 and Over ..	9	4·4	11	9·4
Total	83	83·0	187	187·0
Not Known ..	4		8	

SIGNIFICANCE

Males	$\chi^2 = 8{\cdot}0$; 4 d.f.; $0{\cdot}1 > P > 0{\cdot}05$ (two youngest age groups combined)
Females	$\chi^2 = 6{\cdot}7$; 5 d.f.; $0{\cdot}3 > P > 0{\cdot}2$

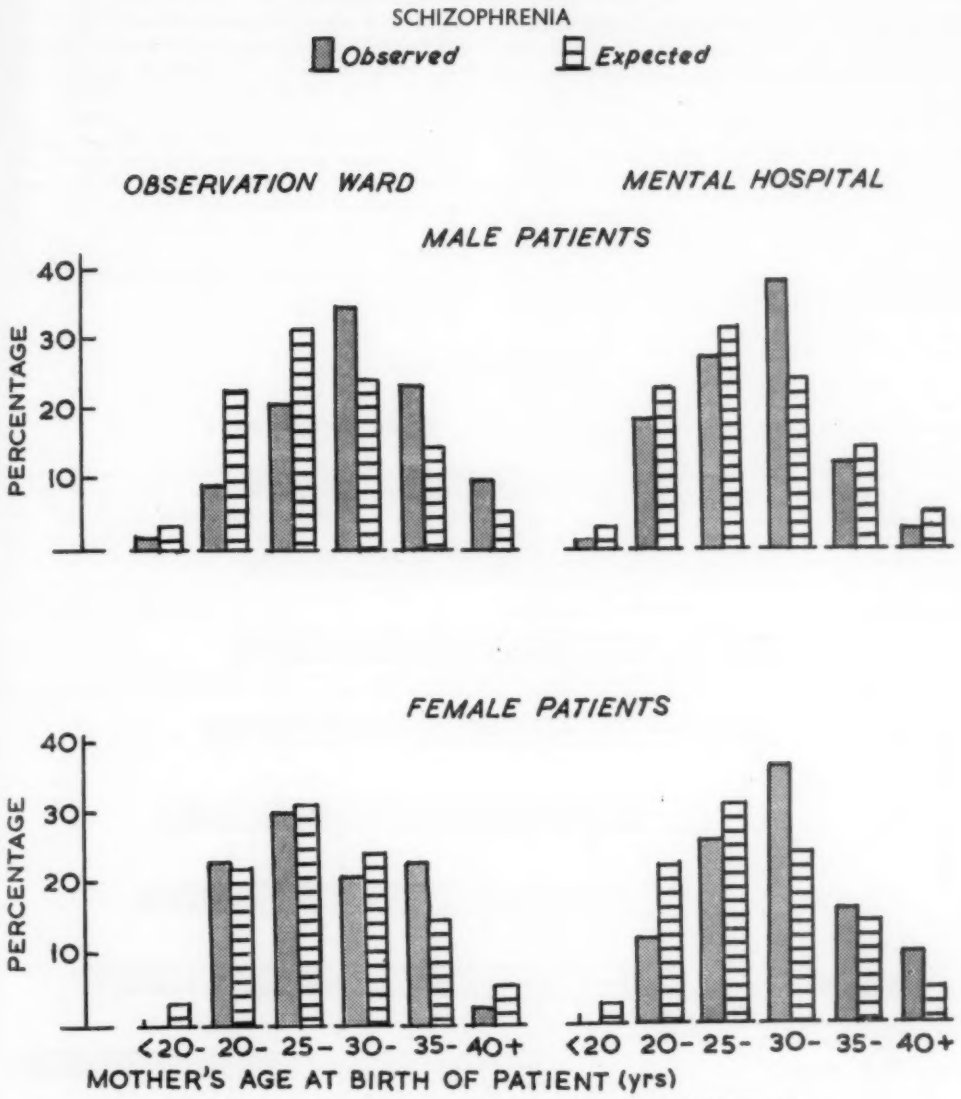

FIG. 2.—Percentage distribution according to maternal age at birth of patient (schizophrenia)

general population for persons born in the same periods (Table V), so that it does not appear that these factors contributed much to the difference found between maternal ages for patients and for the general population.

Thus, in comparison with the mothers of all children born, the four groups of schizophrenic patients showed a deficit of young mothers, a shift of the "peak" towards the older ages, and, with one exception, an excess of older mothers. This exception, that of schizophrenic men in the mental hospital, is considered in the next section.

Size of Family of Schizophrenic Patients

The maternal age of patients would be expected to be older in a group with an undue proportion of large families or of later-born children. This is illustrated in Fig. 3, which shows the distribution of maternal age for Bethlem and Maudsley schizophrenic patients under 45 years of age who were discharged during 1949–1954.

When the observation ward and mental hospital patients are examined, it is found that the mental hospital men come, on the whole, from smaller sized families than the other groups (Table VI opposite). If it is assumed that the maternal age distributions within each family size of these four groups were similar to those of the Bethlem and Maudsley patients, these family sizes can be combined, by weighting according to the number of patients from each size, to give an expected distribution of maternal ages for each group. These are not significantly different from those actually observed, which suggests that the lack of mothers over 35 years of age in the group of men from the mental hospital in comparison with the other groups is due partly to the presence in this group of a disproportionate number of patients from small families.

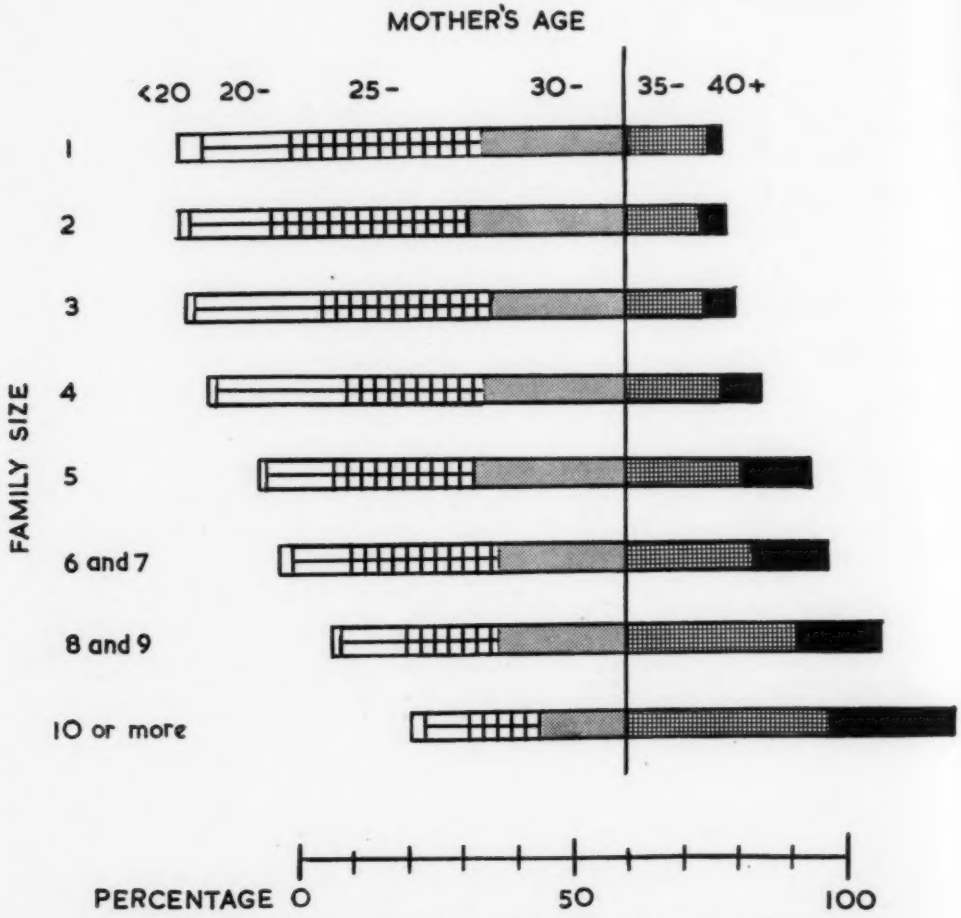

Fig. 3.—Maternal age at birth of schizophrenic patients according to family size (Bethlem and Maudsley Hospitals)

TABLE VI

DISTRIBUTION OF SCHIZOPHRENIC PATIENTS ACCORDING TO SIZE OF FAMILY

Size of Family	Observation Ward				Mental Hospital			
	Males		Females		Males		Females	
	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.
1	4	9	4	9	13	12	12	9
2	7	16	8	17	29	27	29	22
3	8	18	4	9	27	25	23	17
4	4	9	11	24	14	13	18	14
5	3	7	8	17	6	6	16	12
6	6	14	0	0	5	5	8	6
7	2	5	4	9	4	4	10	8
8	1	2	2	4	0	0	8	6
9	3	7	1	2	2	2	3	2
10	2	5	0	0	1	1	4	3
11	1	2	0	0	3	3	1	1
12	3	7	3	7	1	1	1	1
13	0	0	1	2	1	1	0	0
14	0	0	0	0	1	1	0	0
Total	44		46		107		133	
Not Known	3		2		5		12	

This raises the question whether the differences between the groups of schizophrenics and the general population—the shift towards higher maternal age at time of birth—might not in fact be due to over-representation of large families in the schizophrenic groups.

There is little information on size of family for the total population, but the 1946 Family Census for the Royal Commission on Population gives the number of live births for women first married in certain periods. The schizophrenic patients, as shown in Table VI, cannot be compared directly with these figures, since, if all members of a family are equally liable to become patients, a family of, say, eight children has eight times as many chances of being represented as a family of one child. This was pointed out by Greenwood and Yule (1914), who estimated the frequency of the size of families from which groups such as the schizophrenic patients come by dividing the number of sibships of size x by x. The effect of this procedure is illustrated for mental hospital patients in Table VII, col. C. These distributions have been converted into percentage distribution in Table VIII (overleaf) which also includes schizophrenic patients in the observation ward and, for comparison, the family size of fertile marriages contracted in the two periods 1900–9 and 1925–9. The date of marriage of the patients' parents is not known, but only 34 (30 per cent.) of the men and 21 (15 per cent.) of the women among the patients were born after 1929, so that the majority of marriages must have taken place between

TABLE VII

SIZE OF FAMILY AND BIRTH ORDER OF MENTAL HOSPITAL SCHIZOPHRENIC PATIENTS

Sex	Size of Family	Number of Patients	Estimated Frequency of Families containing Patients	Birth Order	Number of Patients* (O)	Expected Birth Order derived from Column C (E)	$\frac{(O-E)^2}{E}$
	A	B	C	D	E	F	G
Male	1	13	13·00	1	37	41·24	0·44
	2	27	13·50	2	31	28·24	0·27
	3	25	8·33	3	15	14·74	0·05
	4	14	3·50	4	10	6·41	2·01
	5	6	1·20	5	2·5	2·91	
	6	4	0·67	6	0·5	1·74	
	7	4	0·57	7	–	1·04	
	8	–	0·00	8	1	0·47	0·72
	9	1	0·11	9	1	0·47	
	10	1	0·10	10	–	0·36	
	11	2	0·18	11	–	0·26	
	12	1	0·28	12	–	0·08	
	Total	98	41·24		98	97·93	$\chi^2 = 3·49$; 4 d.f.; $P \simeq 0·5$
	Not Known	14					
Female	1	12	12·00	1	39	41·12	0·11
	2	25	12·50	2	28	29·15	0·05
	3	20	6·67	3	17	16·62	0·01
	4	15	3·75	4	9·5	9·95	0·02
	5	11	2·20	5	8·5	6·20	0·62
	6	8	1·33	6	5	4·00	
	7	8	1·14	7	2	2·67	
	8	5	0·63	8	1	1·53	
	9	3	0·33	9	1	0·90	0·12
	10	4	0·40	10	1	0·57	
	11	1	0·09	11	–	0·17	
	12	1	0·08	12	1	0·08	
	Total	113	41·12		113	112·99	$\chi^2 = 0·93$; 5 d.f.; $P \simeq 0·96$
	Not Known	25					

*A patient who is a twin is counted as one-half in each birth order

TABLE VIII

PERCENTAGE DISTRIBUTION ACCORDING TO SIZE OF FAMILY OF SCHIZOPHRENIC PATIENTS COMPARED WITH THAT OF ALL FERTILE MARRIAGES

Size of Family	Schizophrenic Patients*				General Hospital Patients*		All Fertile Marriages			
	Mental Hospital		Observation Ward				1900–9		1925–9	
	Males	Females	Males	Females	Males	Females	Non-Manual	Manual	Non-Manual	Manual
1	32	29	28	27	9	29	20	13	35	27
2	33	30	25	27	35	18	26	18	36	27
3	21	16	19	27	17	16	20	15	16	17
4	8	9	11		9	16	13	14	7	11
5	3	5		15	3	4	8	11	3	6
6 and 7	3	6	9		15	10	8	15	2	8
8 and 9	0	2	3	2	5	4	4	8	1	3
10 and Over ..	1	1	4	2	6	3	1	6	–	1

*Frequencies estimated by method described in text

1900 and 1929. It does not appear therefore that very large families were unduly represented among the schizophrenic patients, nor that they played a very important part in causing the high maternal age distribution of patients.

BIRTH ORDER AND POSITION WITHIN THE FAMILY OF SCHIZOPHRENIC PATIENTS

Heron (1907) considered that mental disease was more frequent among first born children than among later births, and it was the analysis of data which he produced to support this which was criticized by Greenwood and Yule and by Weinberg. The reconstruction of frequency of different sizes of sibships, suggested by Greenwood and Yule and used in the previous section, can be extended to estimate the number of affected persons in each birth rank which would be expected if all members of a family were equally likely to be admitted to a mental hospital. These estimates do not differ significantly from the numbers which were actually found (Table VII, cols. D–G). This suggests that there was no excess of schizophrenia among the first or the early born. Malzberg (1940) reached a similar conclusion from a study of admissions to the Manhattan State Hospital.

The relative position in the family may be considered rather than actual order, *i.e.* the patients may be shown as "only", "eldest", "intermediate", and "youngest" children. This differs from the birth order classification of the previous paragraph in that, for example, a fifth child in a family of five would be shown as the "youngest" while the fifth in a family of nine would be an "intermediate" child. The results of this classification are shown in Table IX. In both groups of men the youngest member of the family was represented more frequently than the eldest. If all members of these families were male and were equally likely to be represented, the number of eldest or youngest men expected would be ten for the observation ward patients and 28 for those from the mental hospital.

TABLE IX

RELATIVE FREQUENCY OF SCHIZOPHRENIC PATIENTS ACCORDING TO POSITION IN FAMILY

Position in Family	Observation Ward				Mental Hospital			
	Males		Females		Males		Females	
	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.
Only	4	(9)	4	(9)	13	13	12	10
Eldest	5	(11)	11	(24)	24	25	28	24
Intermediate	20	(45)	19	(41)	27	28	46	39
Youngest	15	(34)	12	(26)	34	35	32	27
Total	44		46		98		118	
Not Known	3		2		14		27	

Neither for the observation ward nor the mental hospital did the observed numbers differ significantly from those expected. The same tendency was shown in Malzberg's figures; of 522 patients he had 126 eldest and 143 youngest of both sexes compared with 129 expected. Wahl (1956) found among a group of 568 schizophrenic naval men that 18 per cent. were first and 26 per cent. last children. The greater number of youngest men may be a true picture of youngest children in the general population.

Social Class of Schizophrenic Patients

Family size and age at marriage differ considerably between different social groups. Some idea of the effect of these differences on the age of mothers at maternity can be obtained from the Registrar General's Occupational Fertility Tables, 1931 and 1939 (Hopkin and Hajnal, 1953), which give maternal ages for all births in England and Wales in 1939 according to the fathers' occupation. The maternal age distributions vary considerably between these groups (Table X). In only three groups was the "peak" child-bearing age of the mother in the 30-34 age group, and in most cases the proportion of mothers under 25 at their child's birth was higher, and the proportion aged 35 and over lower, than among the schizophrenic patients.

The occupation of the patient and of the patient's father was obtained for the observation ward admissions.* These were divided according to the Registrar General's classification (Table XI, overleaf).

(The social class of women patients was not given, as in most cases they were housewives. The Registrar General's practice is to class them according to

*The comparison of the father's occupation, and hence social class, as given by the Registrar General (Table X) and by the patients is not strictly valid. The Registrar General's figures are recorded at the time of registration of the birth, that for the patients at the time of admission or when the father died. It is possible that the occupational class of the father would be higher at the time of the patient's admission than at the time of his birth.

TABLE X

MOTHER'S AGE AT BIRTH OF CHILD—CLASSIFIED ACCORDING TO FATHER'S OCCUPATION

(1939 Registrations in England and Wales)

Social Class	Occupational Group of Father	Mother's Age at Maternity (yrs)							
		Under 20	20–24	25–29	30–34	35–39	40 and Over	Not Known	All Ages
1	Professions	0·6	11·6	37·4	33·3	13·6	3·0	0·5	100
1	Higher Ranks in Banking, Insurance, Transport, etc.	0·6	11·8	37·0	32·6	14·0	3·4	0·6	100
2	Civil Servants above Clerks, Local Government Officials	0·7	13·0	36·1	30·6	14·9	4·3	0·4	100
2	Teachers	0·4	10·2	35·5	35·9	14·6	3·0	0·4	100
2	Employers and Managers in Building Trade	0·9	13·4	35·2	30·6	14·4	4·7	0·8	100
2	Owners and Managers of other Industrial and Commercial Enterprises	1·2	14·7	35·5	29·8	14·0	4·1	0·7	100
2	Farmers and Farmers' Sons	1·6	14·5	28·9	29·1	17·6	7·1	1·2	100
3	Foremen in Mines and Quarries	2·7	11·6	26·9	29·7	20·7	7·8	0·6	100
3	Foremen in Textile Industries	2·2	15·1	31·7	29·4	16·9	4·5	0·2	100
3	Other Foremen	2·1	17·1	30·4	26·9	16·9	6·1	0·5	100
3	Skilled Mine Workers	4·4	23·9	28·1	22·1	14·9	6·1	0·5	100
3	Skilled Textile Workers	4·1	22·1	33·5	24·2	12·4	3·3	0·4	100
3	Skilled Agricultural Workers	3·3	20·2	32·4	25·0	14·1	4·5	0·5	100
3	Skilled Building Workers	4·7	25·2	34·6	22·6	9·7	2·7	0·5	100
3	Other Skilled Workers	3·9	23·6	34·1	22·9	11·5	3·6	0·4	100
3	Clerks, Draughtsmen, Typists	1·6	14·5	37·4	29·7	13·1	3·2	0·5	100
3	Shop Assistants and Higher Ranks of Personal Service	3·9	24·1	36·8	22·7	9·4	2·5	0·6	100
3	"Other Ranks" in Police, Navy, Air Force	4·4	24·2	36·0	22·0	10·2	2·7	0·3	100
4	Semi-skilled Mine and Quarry Workers	6·7	27·9	28·1	22·1	14·9	6·1	0·5	100
4	Semi-skilled Textile Workers	4·5	22·7	31·4	24·2	13·1	3·7	0·4	100
4	Agricultural Labourers	5·4	25·0	29·9	21·0	13·3	4·8	0·6	100
4	Other Semi-Skilled Workers	4·6	24·3	30·9	21·9	13·2	4·7	0·4	100
4	Lower Ranks of Personal Service	3·9	22·5	31·6	24·5	12·6	4·3	0·6	100
4	"Other Ranks" in Army	9·3	31·5	33·6	17·2	6·6	1·4	0·4	100
5	Building Labourers other than "Navvies"	4·9	23·8	30·0	21·2	13·9	5·7	0·5	100
5	Other Unskilled Labourers (excluding Agricultural)	4·7	22·9	29·2	22·0	14·6	6·1	0·5	100
All Social Classes		3·9	22·2	32·7	23·7	12·7	4·3	0·5	100

Adapted from Hopkin and Hajnal (1953) "Analysis of Births in England & Wales, 1939" in the Registrar General's Decennial Supplement, England & Wales, 1931 (Part IIb, Occupational Fertility, 1931 and 1939).

their husband's occupation, but for these patients this was not always known.) The relatively high proportion of male patients with fathers in Social Classes I and II is interesting, as it is generally believed that the incidence of schizophrenia is highest in the lower classes. However, it is not possible to give rates because the population from which the patients were drawn is not known. Classification based on the occupation of the patients does not show such a large proportion of the higher social classes. This is partly due to the fact that some of the patients, particularly the younger ones, were students or had no occupation.

TABLE XI

SOCIAL CLASS OF SCHIZOPHRENIC PATIENTS ADMITTED TO OBSERVATION WARD AND OF THEIR FATHERS

Social Class	Patients	Fathers of	
	(Males)	Males	Females
I and II	4	11	5
III	15	18	22
IV and V	17	12	12
No Occupation and Not Stated	11	6	9

MOTHER'S AGE RELATED TO AGE AT ADMISSION OF SCHIZOPHRENIC PATIENTS

Among the mental hospital men whose maternal age was known, of the 43 admitted for the first time before the age of 25, eleven (26 per cent.) had mothers aged over 35 at the time of their birth; of the other 56 men, admitted for the first time at ages of 25 or over, four (7 per cent.) had mothers aged 35 or over. A possible explanation of this difference is that a relatively old mother may find it more difficult to understand or to manage her rather odd son than a younger mother. Alternatively, it may be an indication that, in men, earlier- and later-presenting schizophrenia are two distinct diseases, and a relationship between incidence and advancing maternal age exists mainly for the former. Female patients do not show this difference.

CONDITION OF PARENTS AT PATIENT'S FIRST ADMISSION

For *all* patients under 35 years of age when first admitted to a mental hospital, almost half had lost one or both parents (Table XII). It is not known whether this is an unduly high proportion compared with the general population, but if the loss of a parent is a factor in the admission of a person to hospital, admissions may include a high proportion of patients whose parents were older than average for their generation.

TABLE XII

STATE OF PARENTS AT TIME OF ADMISSION TO MENTAL HOSPITAL (ALL PATIENTS UNDER 35 YEARS)

State of Parents	Males		Females		Total	
	No.	Per cent.	No.	Per cent.	No.	Per cent.
Both Parents Alive	71	63	60	44	131	53
Mother Alive, Father Dead	23	21	41	30	64	26
Father Alive, Mother Dead	9	8	19	14	28	11
Both Parents Dead	9	8	16	12	25	10
Total	112	100	136	100	248	100
Not Known	9		23		32	

Another measure of incompleteness of the family from which the patient came was taken to be the disruption of the home before the patient was 16 years of age. This included parental death, separation, desertion, and adoption (Table XIII). At least one-fifth of the patients came from disrupted homes and there may be others who did not give this information. It is possible that broken families or parental disharmonies may differentially affect older and younger children.

TABLE XIII

PROPORTION OF MENTAL HOSPITAL PATIENTS FROM "DISRUPTED" HOMES

Diagnosis	Males			Females		
	Total No.	No. from "Disrupted" Homes		Total No.	No. from "Disrupted" Homes	
		No.	Per cent.		No.	Per cent.
Schizophrenia	112	26	23	145	39	28
Psychotic Depression	19	3	(16)	33	4	(12)
Neurotic Depression	10	1	(10)	40	12	(30)
Psychopathy and Neurosis	19	5	(26)	34	8	(24)
Total	160	35	22	252	64	25

SUMMARY

(1) The maternal age at birth of patient was recorded for patients in an observation ward and in a mental hospital in London, and compared with the Registrar General's data for all births,

(2) The schizophrenic patients, both men and women from both observation ward and mental hospital, showed a slightly higher maternal age distribution than was expected. All four groups showed a deficit of mothers under 25 years of age, and (except for men in the mental hospital) an excess of mothers of 35 and over. In the case of the mental hospital men, the small proportion of elderly

mothers was thought to be due to the fact that a disproportionate number of these patients came from small families. This group also showed an association between maternal age and age at first admission to hospital. Home circumstances may have some influence on the time when a patient enters hospital, and in mild cases may even determine whether or not he receives in-patient care. It is possible that the numbers of schizophrenics who remain outside hospital may show no excess of relatively old mothers.

(3) The shift towards higher maternal age for mothers of schizophrenics compared with all births did not appear to be accounted for by unreliability of memory or by differences in social class. There seemed to be a tendency for the schizophrenic man to be the youngest member of his family, but it is not known whether in the general population the youngest member of the family is more frequently male.

My thanks are due to many people for their co-operation and advice: to Professor L. S. Penrose who suggested the investigation; to Professor Aubrey Lewis for his direction and critical interest; to Dr. Vera Norris who started the work; to Miss Seward and Miss Hindson, psychiatric social workers at St. Francis Hospital, who collected all the observation ward data under somewhat trying circumstances; to Mrs. Heyworth-Davis, psychiatric social worker at Springfield Hospital, for help with the collection of the mental hospital data; to Dr. M. Markowe for suggesting and Dr. H. C. Beccle for allowing data from this hospital to be collected; to Miss V. M. Snelling, Matron of St. Giles' Hospital, and Miss M. M. Thorne, Matron of Dulwich Hospital, for arranging interviews with their patients; to Dr. K. Rawnsley for psychiatric help; and to Miss D. Rockett for much assistance in many ways.

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ABO BLOOD GROUPS AND BRONCHOPNEUMONIA IN CHILDREN

BY

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The association between ABO blood groups and certain diseases of the upper intestinal tract, peptic ulcer, gastric carinoma, and pernicious anaemia, is now well established, but this is not true for any of the other associations noted, except perhaps diabetes. The evidence has recently been summarized by Roberts (1957). Of the other associations that have been reported, the one which, if true, would be of most interest as a selective force acting on the relative frequency of the ABO groups is the association between bronchopneumonia in children and the ABO groups other than O. The observation that children of blood group O are relatively resistant to bronchopneumonia was made in 1949 (Struthers 1951). It was based on 400 consecutive *post-mortem* examinations at the Royal Hospital for Sick Children, Glasgow.

Struthers's findings were that 55 children had no apparent abnormality at death apart from bronchopneumonia, and that in this group only fourteen (25·5 per cent) were group O, compared with 51 per cent. group O children in a large control sample from the same area (χ^2 for one degree of freedom: 13·18). Of 93 children with bronchopneumonia associated with other abnormality, only 33 (35·5 per cent.) were group O, giving χ^2 for one degree of freedom: 8·16 in comparison with the contact sample. We note that there is no significant difference in the percentage of group O between the group with bronchopneumonia alone and that with bronchopneumonia in association with other abnormality, and in the combined series of 148 there are 47 group O children (31·8 per cent.), giving χ^2 for one degree of freedom: 20·5 in comparison with the control group. Struthers found that the deficit of group O children in his total series of 400 was largely confined to the 320 children under 2 years old, but he did not give the blood groups separately for children under 2 years old with or without bronchopneumonia. The ABO blood group distribution of the 252 children dying without bronchopneumonia did not differ significantly from that of the control sample.

We attempted to repeat Struthers's observations on children who came to *post-mortem* examination at the Hospital for Sick Children, London. A special examination was made by one of us (B.H.) of the sections of the lung of those children whose blood groups had been determined and who died between 1949 and 1955. The blood groups were not known to B.H. at the time of histological examination. There were 358 examinations but they were not consecutive. Usually only a proportion of the children available for necropsy were blood grouped, and in a few instances permission was given for only a limited examination which did not include the lungs. The total number of children examined *post-mortem* during these years was 964. The incompleteness of the series should not have introduced any bias, because inclusion was independent of the blood group and of the presence or absence of bronchopneumonia. The blood groups were determined by the tube and not the slide method.

It was soon apparent that the repetition of Struthers's observations could not be complete since no child in the London series had bronchopneumonia without other associated abnormalities. Few requests are received at the hospital for the admission of children with uncomplicated bronchopneumonia and the effective treatments now available have reduced mortality. But there were 171 children with bronchopneumonia in association with other abnormalities on which to base a comparison with Struthers's whole group of 148, or perhaps, more justly, with his group of 93 with bronchopneumonia associated with other abnormality.

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The lung sections were graded for bronchopneumonia into four groups:

(1) No bronchopneumonia: no evidence of inflammation

(2) Bronchopneumonia Grade 1: bronchiolitis with commencing infiltration of the lung tissue—the very earliest lesion diagnosable as pneumonia (as opposed to bronchiolitis).

(3) Bronchopneumonia Grade 2: definite consolidation involving part of the pulmonary lobule.

(4) Bronchopneumonia Grade 3: consolidation affecting the whole pulmonary lobule, including cases showing abscess formation.

In view of the differing quantities of lung tissue available for histological examination, it was not possible to compare the total extent of the lesions present in different specimens. The pneumonic process was therefore graded according to the maximum lesion present. The possibility that any given sections did not show the maximum lesion present in the lung is unlikely except in the case of very early pneumonia, as the customary practice in selecting histological material is to examine the areas which appear most abnormal to the naked eye.

The distribution by blood group is shown in Table I for the whole group dying at ages ranging from birth to 13 years, graded according to the absence or presence of bronchopneumonia and the degree of bronchopneumonia. The distribution is compared with a control series for the London area (Discombe and Meyer, 1952), which has proved typical of London and South East England.

The grouping of the children without bronchopneumonia is, as in Glasgow, similar to that of the controls. For the children with bronchopneumonia there is a small deficit of group O compared with "not O", a difference in the same direction as that found by Struthers (1951), but much smaller and not significant, (χ^2 for one degree of freedom: 1·78) These comparisons are shown in Table II.

TABLE I

BLOOD GROUPS OF CHILDREN DYING AT AGES RANGING FROM LESS THAN 1 TO 13 YEARS IN THE HOSPITAL FOR SICK CHILDREN, LONDON

Blood Group	No. of Controls	No. of Children with:				
		No Broncho-pneumonia	Bronchopneumonia*			
			Grade 1	Grade 2	Grade 3	All Grades
O	4,578	91	18	20	31	69
A	4,219	73	20	33	24	77
B	890	16	4	6	8	18
AB	313	7	3	3	1	7
Total	10,000	187	45	62	64	171

* Criteria for grading are given in the text

The distribution for children under 2 years of age is shown separately in Table III (overleaf). The deficit of group O among those with bronchopneumonia is slightly, but not significantly, increased (χ^2 for one degree of freedom: 2·57).

Further, the sub-grouping of those with bronchopneumonia into three grades reveals no definite trend for the proportion who are group O to decrease with an increasing degree of inflammation.

It is possible to confirm whether Struthers's findings are definitely incompatible with our own by Woolf's method, which makes allowance for the different blood group distributions in the control population (Woolf, 1955). If the comparison is made with Struthers's whole group with bronchopneumonia (which includes those with bronchopneumonia and no other apparent abnormality), the two series are very probably not compatible (χ^2 for one degree of freedom: 5·98), but if the comparison is made with

TABLE II

COMPARISON OF PROPORTION GROUP O AMONG CHILDREN WITH BRONCHOPNEUMONIA DYING AT THE ROYAL HOSPITAL FOR SICK CHILDREN, GLASGOW, AND THE HOSPITAL FOR SICK CHILDREN, LONDON

Blood Group	Glasgow						London			
	Controls		Children with Bronchopneumonia				Controls*		Children with Bronchopneumonia With Associated Abnormality	
			With Associated Abnormality		With and Without Associated Abnormality					
	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.
O	3,063	50·96	33	35·48	47	31·76	4,578	45·78	69	40·35
A+B+AB	2,948	49·04	60	64·51	148	68·24	5,422	54·22	102	59·65

For Glasgow (all bronchopneumonia) $\chi^2 = 20·54$; D. of F. $= 1$; $P < ·001$
For Glasgow (bronchopneumonia with associated abnormality) $\chi^2 = 8·16$; D. of F. $= 1$; $P < 0·005$
For London (all bronchopneumonia, including none without associated abnormality) $\chi^2 = 1·78$; D. of F. $= 1$; $0·1 < P < 0·2$

* Discombe and Meyer, (1952)

TABLE III

BLOOD GROUPS OF CHILDREN DYING AT THE HOSPITAL FOR SICK CHILDREN, LONDON

Blood Group	No. of Children dying at less than 2 years with:					No. of Children dying at 2 to 13 years with:				
	No Broncho-pneumonia	Bronchopneumonia				No Broncho-pneumonia	Bronchopneumonia			
		Grade 1	Grade 2	Grade 3	All Grades		Grade 1	Grade 2	Grade 2	All Grades
O	67	11	16	22	49	24	7	4	9	20
A	54	13	25	21	59	19	7	8	3	18
B	11	4	4	6	14	5	0	2	2	4
AB	3	2	3	1	6	4	1	0	0	1
Total	135	30	48	50	128	52	15	14	14	43

his group dying of bronchopneumonia associated with other abnormality, the London and Glasgow series are compatible (χ^2 for one degree of freedom: 2·37).

While, therefore, Struthers's findings are not confirmed in this London series, it does not follow that there is no phenomenon to investigate. It is not inconceivable that the degree of association differs in different areas of the country, and further studies would be valuable.

SUMMARY

The lungs of the children (358) on whom autopsy was performed at the Hospital for Sick Children, London, from 1949–55 inclusive, and whose ABO blood group was known, were graded according to the degree of bronchopneumonia if present. Struthers (1951) had reported a similar series from Glasgow showing a marked deficit of children of blood group O among those with bronchopneumonia alone and those with bronchopneumonia associated with other abnormality. In the London series there were no children with bronchopneumonia alone, and in the 171 with bronchopneumonia in association with other abnormalities the ABO blood group distribution did not differ significantly from that of the general London population. Comparison with Struthers's series shows no significant evidence of heterogeneity between the London and Glasgow groups with bronchopneumonia associated with other abnormality, but there is heterogeneity if the Glasgow cases with bronchopneumonia alone are included.

We are indebted to Dr. Martin Bodian for access to the *post-mortem* specimens and the *post-mortem* records, to Dr. Ian Cathie for the blood group determinations, and to Dr. J. A. Fraser Roberts for much helpful advice on methods of analysis.

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AN INVESTIGATION OF THE GROWTH OF CHILDREN AT AN OPEN AIR SCHOOL

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Between June, 1951, and October, 1954, the growth of children attending an open air school was compared with that of children in ordinary schools.

The open air school (The Newman School), recently built and well equipped, is situated in a pleasant part of Rotherham, with its own gardens and orchard. The regime is specially designed to improve the children's general health. The children are collected daily near their homes and taken by bus to the school where they receive a light breakfast. They spend the morning doing ordinary classwork in rooms having at least one side open to the air except in extremely cold weather. When weather and other conditions allow, the children work completely in the open. There is a morning break for milk, and after a normal school lunch all the children lie down for three-quarters of an hour before beginning the afternoon's programme. This consists of a light syllabus of school work; nature walks, gardening, craft-work, singing, dancing, and physical training take up most of the time, and there is very little formal indoor class-work. At 3.30 the children have tea, consisting of milk and sandwiches or scones. They leave by bus at about 4 p.m.

Material

Children are selected to attend the Newman School for remedial treatment for a variety of physical conditions, among them general (nutritional) debility. Originally a group of 127 boys and girls aged 7–15 years who were expected to remain for at least a year was selected on nutritional grounds alone. For comparison with this group, sixty healthy children of the same ages who attended a local primary and secondary modern school, and a group of 36 brothers or sisters of the Newman children attending local schools, were selected to act as controls. These groups are referred to as the "nutritional group", "controls", and "siblings" respectively. The children's progress was followed until they left school; no new entrants were taken on. Children left the Newman School when one of us (J.A.G.), as medical officer, considered them fit to attend ordinary schools or when they reached the age of 16. As many as possible of the children who left were followed up afterwards.

Nutritional Group.—These children, regarded as undernourished and needing special care, were mainly, but not entirely, from poor homes in poor financial circumstances living in less healthy areas of the town.

Sibling Group.—This consisted of all the brothers or sisters of the "nutritional group" who were attending local schools. These children, therefore, had the same home conditions as those in the "nutritional group", but none of them appeared to be in need of special treatment on account of debility or illness. The schools they attended were, in general, less modern and in less favoured districts than the control schools.

Control Group.—This was composed of children specially selected by the medical officer and school nurses as being in good health. They attended a primary school or a secondary modern school on the same site in fairly modern buildings in a pleasant part of the town. The children were drawn mostly from new housing estates and followed the normal school routine.

Procedure

All children were measured annually in some twenty body measurements, including weight, length, girth, and breadth, and six subcutaneous fat measurements. The groups were compared with respect to physique and development. Weights were taken monthly; height, chest, and knee girths, hand breadth, inter-spinous and trochanteric breadths, and the six skinfold thickness measurements were

taken every 3 months. The techniques have been described elsewhere (Hammond, 1953 a, b; 1955). Intelligence and scholastic tests were applied to all but the "sibling" children; school attendance and home background records were kept of sub-groups. (The mental test results are not included in the present communication.)

Results

(*a*) *Cross-Sectional Results.*—Not all the measurements taken are reproduced here; those selected have been chosen with the object of covering as many aspects of physique as possible.

Table I gives the mean measurements at each age for both sexes, for weight, height, acromial breadth chest girth, body fat, and the ratios Sitting Height: Leg Length and Weight : Height. Formulae for predicting appropriate weight for a given skeletal size have been developed (Bransby and Hammond, 1951), and the actual weights relative to the expected weights are also shown. Standards of comparison consisting of the mean weights and heights of L.C.C. School Children (Daley, 1950), and body fat and other measurements (Hammond, 1953 a b, 1955) are also included.

Children mostly entered the Newman School at about the age of 8 years (except during the early

MEASUREMENTS AND GR

BOYS

Age (yrs)	Group	No. in Group	Weight (kg.)	Height (cm.)	Shoulder Breadth (cm.)	Chest Girth (Nipple) (cm.)	Body Fat (0·1 mm.)	Sitting Height Leg Length	Weight Minus Predicted Weight (kg.)	Weight Height	No. in Group
7	Nutritional ..	4	21·0	118·5	26·0	59·6	37·5	1·135	−0·1	0·	7
	Sibling.. ..	2	23·3	123·3	27·8	58·8	33·0	1·052	−0·04	0·	1
	Controls ..	1	27·0	127·4	29·5	60·5	38·2	1·145	1·7	0·	1
	Standard ..	—	24·3	123·2	27·0	—	42·5	1·109	—	0·	—
8	Nutritional ..	16	22·9*	125·0*	26·9	59·6	37·4*	1·062	−1·2*	0·	3
	Sibling.. ..	6	23·7*	125·5	27·8	59·8	36·0*	1·061	−1·2	0·	4
	Controls ..	7	28·7	129·0	28·7	62·1	61·0*	1·080	1·0	0·	6
	Standard ..	—	26·9	127·4	28·0	—	43·0	1·072	—	0·	—
9	Nutritional ..	21	25·1*	130·5	28·1	62·0	38·0*	1·017	−1·6*	0·	7
	Sibling.. ..	6	24·2*	129·4	28·5	61·9	27·4*	1·045	−2·4*	0·	5
	Controls ..	10	28·4	130·7	28·9	64·2	51·3	1·049	0·3	0·	9
	Standard ..	—	25·4	133·1	28·6	—	47·0	1·046	—	0·	—
10	Nutritional ..	25	27·2*	131·4*	28·9	63·4	37·2*	1·010	−0·7*	0·	29
	Sibling.. ..	6	27·2*	132·9	29·2	64·0	31·2*	1·019	−2·1*	0·	6
	Controls ..	13	31·5	134·2	30·0	67·5	58·0	1·020	−0·09	0·	12
	Standard ..	—	32·1	137·6	29·6	—	50·0	1·030	—	0·	—
11	Nutritional ..	29	28·0*	139·1*	29·8	64·5	37·9*	0·988	−3·4*	0·	30
	Sibling.. ..	6	30·6*	135·8*	28·3	66·0	37·4*	1·045	−0·6	0·	7
	Controls ..	13	32·9*	137·4	30·6	68·8	55·3	0·992	−0·8	0·	17
	Standard ..	—	34·7	141·2	30·0	—	52·0	1·005	—	0·	—
12	Nutritional ..	21	31·8*	144·1	30·7	66·9	37·2*	0·989	−3·3*	0·	28
	Sibling.. ..	6	32·2*	143·9	31·0	66·7	44·0*	0·990	−1·1	0·	9
	Controls ..	12	35·0*	143·0	31·4	69·1	54·5	0·983	−0·6	0·	17
	Standard ..	—	38·6	145·9	31·0	—	52·5	0·981	—	0·	—
13	Nutritional ..	18	33·6*	146·5*	31·5	65·6	38·8*	0·986	−2·8*	0·	29
	Sibling.. ..	8	34·3*	147·1*	31·6	68·4	41·0*	0·981	−2·4	0·	8
	Controls ..	15	41·0	153·0	33·0	73·7	53·9	0·959	−1·0	0·	16
	Standard ..	—	42·9	152·0	32·0	—	52·0	0·955	—	0·	—
14	Nutritional ..	18	36·7*	152·3	32·9	71·7	38·0*	0·986	−2·9*	0·	23
	Sibling.. ..	5	44·9	154·8	33·2	72·7	61·7	0·966	−1·5*	0·	3
	Controls ..	16	46·8	160·5	34·7	76·0	50·7	0·949	—	—	15
	Standard ..	—	47·6	158·0	33·5	—	51·0	0·985	—	0·	—
15	Nutritional ..	5	39·0*	156·6	33·8	73·4	37·7*	0·952	−4·2*	0·	7
	Sibling.. ..	2	62·2*	164·3	33·8	66·5	110·5*	0·994	11·1*	0·	3
	Controls ..	6	50·1	165·4	35·5	78·9	50·5	0·873	−0·8	0·	5
	Standard ..	—	54·9	165·7	35·0	71·0	50·0	—	—	0·	—
16	Nutritional ..	1	41·9	162·5	36·5	78·0	37·0*	0·909	−6·0*	0·	2
	Sibling.. ..	—	—	—	—	—	—	—	—	—	1
	Controls ..	1	57·6	168·0	36·0	83·5	60·9	0·944	1·6*	0·	—
	Standard ..	—	60·8	172·0	36·0	82·0	54·5	—	—	0·	—
17	Nutritional ..	—	—	—	—	—	—	—	—	—	2

*Denotes significantly different from standard ($P = 0·05$)
K = a constant to equalize the standard deviations of weight and height

years when the school was being established); hence children first measured at the older ages had attended the school longer than the younger children. Results for the 3 years of the study were analysed separately, but no consistent differences between them were found. The third-year measurements for age group 7 coincided very closely with the second-year measurements for age group 8 and the first-year measurements for age group 9, and these have therefore been combined.

The "nutritional" group had lower than average weight, height, and body fat at all ages. Their weights for the corresponding heights were also lower than average, but the ratio of trunk to leg length, which tends to decrease with age and reflects the changing proportions with maturation, was actually lower than the age norms, which suggests that these children were certainly not retarded in maturation. The measurement of children in the "sibling" group showed a similar inferiority, but the girls were nearer the norms. The "control" girls were well above the standards but only the younger boys were above. The results, so far, agree with what we would expect from the method of selection of the groups, and they show that the different physical criteria agree as a whole with the clinical assessment. Even the skeletal measurements, which are only influenced by fairly long-term effects, also showed the group

AND GROUP

GIRLS

Weight / Height	No. in group	Weight (kg.)	Height (cm.)	Shoulder Breadth (cm.)	Chest Girth (Xiphoid) (cm.)	Body Fat (0·1 mm.)	Sitting Height / Leg Length	Weight minus Predicted Weight (kg.)	Weight / Height × K
0·3	7	18·6*	112·3*	25·2	55·4	43·8	1·067	−0·6	0·365
0·4	1	19·4	118·2	25·5	51·0	41·5	1·087	−1·8*	0·361
0·4	1	24·9	121·6	27·0	57·5	(57)	1·068	0·04	0·451
0·4	—	23·3	121·6	26·0	56·5	50·5	1·089	—	0·423
0·4	3	21·6*	120·6*	26·8	56·5	49·9	1·033	−0·1	0·397
0·4	4	23·1*	123·6	27·0	56·5	59·6	1·088	−0·2	0·412
0·4	6	30·0	129·3	29·0	50·1	91·0	1·077	1·8*	0·513
0·4	—	25·8	126·1	27·0	58·0	60·0	1·068	—	0·450
0·4	7	23·3*	125·0*	27·79	57·3	52·9	1·028	−0·7	0·410
0·4	5	24·8*	127·5	28·30	57·8	55·9	1·030	−1·1	0·429
0·4	9	31·2*	133·7	31·92	61·2	80·3	1·037	1·9*	0·509
0·4	—	28·6	130·7	28·0	60·0	63·0	1·040	—	0·480
0·4	29	25·9*	130·8*	28·36	58·9	54·5	1·015	−1·1*	0·432
0·4	6	28·2*	131·4	29·33	60·0	67·8	1·045	0·2	0·471
0·5	12	33·7*	139·2	33·04	62·2	80·0	1·015	0·4	0·532
0·5	—	31·5	136·1	29·0	61·0	54·0	1·028	—	0·506
0·4	30	29·1*	137·3*	31·31	61·2	53·6	1·014	−2·4*	0·470
0·4	7	32·7	139·1	30·57	62·5	78·3	0·973	−0·5	0·520
0·5	17	32·5*	140·9	31·59	65·5	68·8	1·009	−0·8	0·542
0·5	—	35·8	142·6	30·0	64·0	69·0	1·010	—	0·552
0·4	28	32·6*	143·8	31·23	63·6	55·7	0·994	−2·1*	0·497
0·4	9	33·8*	144·9	30·61	61·8	55·5	0·969	−0·9	0·515
0·5	17	36·9*	147·6	32·53	65·5	73·8	1·008	−0·5	0·550
0·5	—	40·4	148·5	31·0	66·0	74·0	1·003	—	0·596
0·4	29	37·2*	149·5*	32·52	64·9	62·2	0·994	−1·4*	0·547
0·5	8	39·5*	150·2	32·12	64·8	67·3	1·033	−0·9	0·578
0·5	16	47·6*	156·4	34·16	67·19	87·9	1·000	−0·9	0·670
0·6	—	45·0	153·1	32·0	67·0	88·0	1·007	—	0·646
0·5	23	40·5*	153·6	33·04	66·4	61·0	0·987	−3·5*	0·560
0·6	3	48·3	153·9	34·0	66·8	97·3	1·062	2·7	0·669
—	15	50·2	158·6	35·0	69·3	94·7	0·986	−2·0*	0·698
0·6	—	49·2	150·9	34·0	69·0	96·0	1·016	—	0·692
0·5	7	37·1*	148·0*	32·5	64·5	62·1	1·044	−1·5	0·546
0·7	3	(47·3)	159·0	34·25	68·7	94·5	1·006	−0·5	0·656
0·6	5	51·0	156·7	34·7	72·5	104·1	1·018	0·2	0·718
0·7	—	52·2	162·5	34·0	70·0	100·0	—	—	0·705
0·5	2	(36·5*)	145·6*	30·2	65·7	70·7	1·039	2·1	0·553
—	1	(45·3*)	159·2	36·0	67·5	105·0	—	−3·4*	0·628
0·6	—	—	—	—	—	—	—	—	—
0·7	—	58·0	167·5	34·0	71·0	—	—	—	—
—	2	43·1	154·4	31·8	67·2	107·0	—	−2·7*	0·613

TABLE II

PERCENTAGE OF MEASUREMENTS ABOVE AGE STANDARDS IN DIFFERENT PHYSICAL CRITERIA

Sex	Group	No. in Group	Measurement					
			Weight	Height	Chest Girth	Shoulder Breadth	Body Fat	Weight minus Predicted Weight
Boys	Nutritional	159	7	28	17	34	7	9
	Sibling	47	5	23	18	47	7	14
	Control	92	44	47	51	52	50	41
Girls	Nutritional	179	12	30	29	43	20	26
	Sibling	51	24	23	26	55	52	37
	Control	97	51	53	53	75	70	53

differentiation, suggesting that the "nutritional" group inferiority (whether due partly or wholly to nutritional influences) had been operating for some time previously.

"IDEAL" WEIGHTS.—All children of a given age cannot be expected to have the same weight, even if they have the same height, and a rather more complicated function than the weight for height ratio was used throughout in order to make allowance for the differences in skeletal framework between the groups. The regression of weight on height, shoulder (acromial) breadth, hip (trochanteric) breadth, and hand breadth, was used to calculate the expected weight in relation to these measurements, and any difference between the actual weight and the calculated weight would be due to other parts, chiefly muscle and fat. The differences between actual and expected weights are shown in Column 7 of Table I. In general, the results are very similar to those for weight according to height, the "nutritional" and "sibling" groups being low in weight even compared with their smaller skeletal framework, and the "controls" showing an excess of weight. What applies to the group does not necessarily apply to each individual, and Table II shows the percentage of children in each group above the standards.* (The results for the 3 years are combined.)

The percentages reaching the standards for each age were not greatly different for each of the years 1951–54, except in the nutritional group in which the numbers above average in weight rose from 8 to 19 per cent., and above average in height from 16 to 23 per cent. for girls, and from 23 to 36 per cent. for boys. Body fat was the single criterion which agreed best with the group selection, since only 13 per cent. of the "nutritional" children reached the standard, whilst over 60 per cent. of "controls" reached or exceeded it. Attained weight gave the next closest agreement.

PHYSICAL TYPE.—This is largely a constitutional matter but, as measured by the relation of girth measurements to linear (bone) measurements, it is also influenced by environment.†

The nutritional group contained the most leptosomes (long, thin type), the controls contained most eurysomes (stocky, muscular or fat types), and the siblings were about equally divided.

Group	Percentage	
	Leptosomes	Eurysomes
Nutritional	63	37
Sibling..	49	51
Control	41	59

This association between physical type and nutritional grouping could mean either that the initial selection of the children took into account physique as one factor in the clinical appraisal, so that the leptosomes being thinner were more often downgraded than the other types, or that the leptosome type is more prone to suffer from general debility (See also Bransby and Hammond, 1951). In fact, however, the actual type measurements were not known at the time of selection.

(*b*) *Longitudinal Results.*—As some children left during the study it was not possible to use the cross-sectional results to give any precise information on the growth changes in the different groups. The actual growth in weight and height has therefore been analysed. Growth differs much less than

*50 per cent. is the expected value for a normal distribution if the mean is equal to the standard. In children's weight and body fat measurements which are skewed, 40 per cent. of children were above the means (unpublished data). This percentage was sufficient to balance the 60 per cent. below standard, since positive deviations can be much higher than negative ones.

†The type "scores" were determined as weighted sums of length and breadth measurements, the weights being the regression coefficients between the measurement and the type distinction as previously derived from factor analyses of children's measurements (Hammond, 1953 b). Children were then classified as leptosomes or eurysomes according to their relation to the average values for age and sex.

TABLE III

MEAN ANNUAL GAINS IN WEIGHT AND HEIGHT FROM 1951 TO 1954

Year	Group	Boys				Girls			
		No. in Group	Mean Age (yrs)	Weight Growth (kg.)	Height Growth (cm.)	No. in Group	Mean Age (yrs)	Weight Growth (kg.)	Height Growth (cm.)
1951–52	Nutritional ..	40	10·5	2·54±0·21	5·78±0·23	45	10·8	3·00±0·18	5·77±0·21
	Sibling	10	10·7	2·75±0·54	5·45±0·30	13	10·5	3·59±0·48	5·48±0·71
	Control	28	11·0	3·45±0·39	5·79±0·29	29	11·1	4·59±0·31	5·12±0·31
	L.C.C. Standard		10·5	3·55	5·2		11·0	3·82	5·4
1952–53	Nutritional ..	31	10·7	2·82±0·18	5·42±0·28	39	11·4	4·20±0·31	6·10±0·33
	Sibling	9	10·9	2·90±0·39	5·47±0·33	10	11·5	3·52±0·75	4·68±0·64
	Control	22	11·6	4·80±0·28	6·14±0·36	20	11·6	4·24±0·64	6·19±0·48
	L.C.C. Standard		11·0	3·77	5·4		11·5	4·05	5·3
1953–54	Nutritional ..	23	11·6	3·65±0·30	5·57±0·37	28	12·0	4·31±0·41	5·94±0·47
	Sibling	6	12·0	4·49±1·04	6·03±0·75	7	11·5	3·85±0·32	5·51±0·59
	Control ..	15	12·8	5·08±0·60	6·00±0·45	13	11·7	5·83±0·75	4·29±0·56
	L.C.C. Standard		12·0	4·23	5·35		12·0	4·13	5·2

TABLE IV

PERCENTAGE OF CHILDREN WITH GROWTH GREATER THAN AGE STANDARDS

Group	Boys				Girls			
	Number of Measurements	Weight	Height	Body Fat	Number of Measurements	Weight	Height	Body Fat
Nutritional	94	25	52	61	112	40	58	50
Sibling	25	18	42	55	30	50	53	68
Control	65	41	55	55	62	61	38	64

attained measurements from one age to another (except at the pubertal spurt) and hence the growth in weight and height has been combined for all ages of children in the three groups. The mean ages rarely differed by more than a few months. The weight and height increases and their standard errors for each of the 3 years of the study, are set out in Table III, together with the mean ages of the groups and the annual weight and height differences for L.C.C. children in these age ranges (Daley, 1950). Table IV gives the percentage of children whose growth in weight and height and change in body fat was greater than their age standards.

In general, only the "control" group had weight gains consistently above the standard L.C.C. differences, but for all groups of boys, and also for the girls of the "nutritional" group after the first year, the mean height growth was greater than the L.C.C. differences.

There was no marked change relative to the L.C.C. figures during the course of the study, although more children of all groups gained body fat at a greater rate than the standard's change with age, especially towards the end of the study. Over the 3 years the "control" boys gained most weight and height, whilst the "control" girls gained most weight but not height (some tending to put on too much fat).

These growth results are more favourable to the "nutritional" groups than are the cross-sectional results, but although their height gain exceeded that of L.C.C. children, the weight gain did not keep pace.

WEIGHT GROWTH IN RELATION TO HEIGHT GROWTH.—Growth in weight and height may be plotted against each other and it is then found that the average relationship tends to have the same slope for all years within the following age ranges:

Boys 7–12 and 13–15 years;
Girls 7–10, 11–12, 13–16 years.

Over these ages, therefore, we can compare the number of children within the "nutritional", "sibling", or "control" groups whose weight gain relative to their height gain for age is greater or less than the average, and these children may then be combined over the whole age range. The results are shown in Table V.

TABLE V

RELATION BETWEEN GAINS IN WEIGHT AND HEIGHT

Sex	Group	No. in Group	Percentage with Weight Gain related to Height Gain	
			High	Low
Boys	Nutritional ..	89	43	57
	Sibling	27	61	39
	Control	51	64	36
Girls	Nutritional ..	112	41	59
	Sibling	65	60	40
	Control	25	66	34

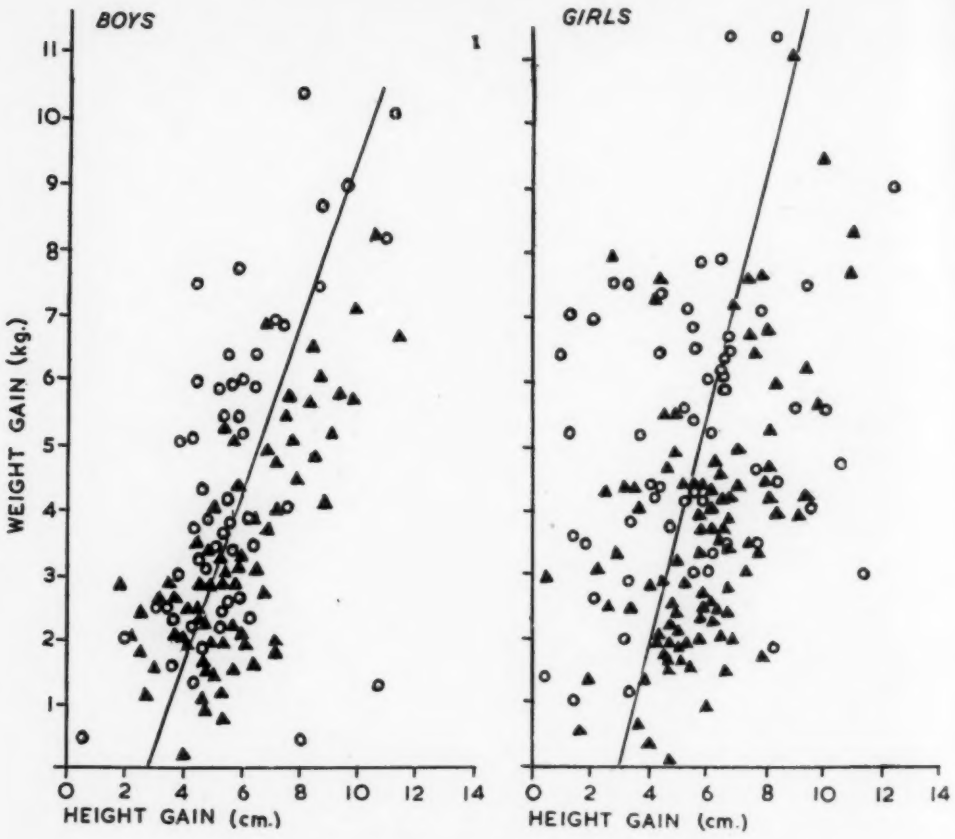

FIGURE.—Annual weight gain according to height gain in boys and girls.

The Figure shows that not only do the "control" children (o) gain more weight and height than the "nutritional" children (▲), but that also the points for the "control" groups are mainly to the left of those for the "nutritional" groups. This shows that, even when the height gains are the same for the two groups, the "controls" gain more weight, or alternatively that the children of the "nutritional" groups require a greater height gain than those in the "control" groups in order that their weight gain should be the same.

These results confirm the findings shown above that weight growth is affected by nutritional conditions more than height growth.

GROWTH DURING SCHOOL HOLIDAYS.—The Newman regime operates only during term time* and it is interesting to compare the growth during the summer holiday months of July and August. This averaged from about one-fifth to one-quarter of the year's growth (Table VI, opposite).

The "siblings" gained the biggest proportion of their annual weight increase, whilst the Newman girls gained less than the normal proportion and the Newman boys were about average.

*There was a shorter summer break than in other schools and a school camp was organized, but the growth was compared for the same period.

TABLE VI

GROWTH DURING SUMMER HOLIDAY AS PERCENTAGE OF ANNUAL WEIGHT GAIN

Group	Boys			Girls		
	No. in Group	Weight Gain (kg.)	Percentage of Annual Gain	No. in Group	Weight Gain (kg.)	Percentage of Annual Gain
Nutritional	45	0·63	21·6	53	0·57	15·1
Sibling	16	0·91	27·4	12	1·12	26·7
Control	31	2·91	21·5	30	1·05	20·7

TABLE VII

MEAN WEIGHT AND HEIGHT GAINS OF CHILDREN STILL AT THE NEWMAN SCHOOL COMPARED WITH THOSE WHO LEFT

Age (yrs)	Present Newman Pupils (Debilitated)						Former Newman Pupils					
	Weight Gain (kg.)				Height Gain (cm.)		Weight Gain (kg.)				Height Gain (cm.)	
	No.	Boys Gain	No.	Girls Gain	Boys	Girls	No.	Boys Gain	No.	Girls Gain	Boys	Girls
9	18	2·2	14	2·9	5·3	5·2	1	1·4	2	1·7	4·5	5·0
10	17	2·6	18	2·8	4·6	6·4	3	2·1	1	2·8	4·6	4·0
11	13	3·3	24	4·0	5·2	6·9	3	2·9	3	2·8	6·3	5·9
12	10	3·6	21	4·7	6·9	6·3	2	3·1	6	4·9	6·5	6·0
13	11	4·5	13	4·7	6·7	5·2	2	4·8	5	4·8	7·3	3·4
14	5	5·8	5	2·5	7·8	3·0	–	—	–	—	—	—
15	–	—	2	3·8	8·0	3·3	1	5·6	1	0·2	7·3	1·1

These results suggest that the children in the "nutritional" groups would probably have fared unfavourably compared with their siblings if they had not been receiving the Newman School treatment. This is confirmed by an analysis of the annual growth in weight and height of the Newman children who left the school when they were considered fit enough to attend ordinary schools, compared with that of the children still remaining (Table VII)

Although the numbers are small, at practically all ages the children who left the Newman school failed to grow as much as those remaining, despite the fact that they were no longer considered to be debilitated.

SCHOOL ATTENDANCE.—In addition to growth and the other physical criteria of health, illness records afford the most direct information on whether conditions are adequate or not. Full health and absence records were kept at the Newman School, but it was not possible to obtain such detailed health records for the control group. Nevertheless, each child was seen monthly and any medical attention received was noted. Overall attendance figures for the Newman and control children still in the study in 1954 for the 3 years during which the study had been in progress are shown in Table VIII.

The figures include all causes of absence, and probably under-estimate the difference between children in the "nutritional" and "control" groups. As there was some pressure for places there was a greater incentive for the Newman school children to attend regularly except when prevented by genuine ill-health, lest they should lose their place at the school. Further, a bus picked up the Newman children from their homes, so that they were less likely to stay away on account of bad weather than those attending other schools. The figures show a very good health record for the controls and a less good one for the "nutritional" group.

TABLE VIII

RELATION BETWEEN GAINS IN WEIGHT AND HEIGHT

School	Newman				Control			
	Boys		Girls		Boys		Girls	
	No.	Mean Percentage Attendance	No.	Mean Percentage Attendance	No.	Mean Percentage Attendance	No.	Mean Percentage Attendance
Junior	18	87·9	11	83·9	14	95·1	15	94·5
Senior	8	87·8	17	86·8	15	96·0	21	91·8

Within-school correlations between attendance and physical criteria were calculated for both boys and girls in order to see whether there was any association apart from that shown by the generally higher attendance and superior physical characteristics of the control children compared with the "nutritional" group. (Only 6 per cent. of control children had as much absence as the average for the Newman school children and only 10 per cent. had as low attained weight or weight-for-height.) However, the correlations were not significantly different from zero, and

within the same schools, therefore, the children with most absence did not differ in physique from the other children.

HOME CONDITIONS.—As already remarked, the Newman School regime could only operate during term time and then only for part of the day and, therefore, home conditions could still affect the children's progress. Assessments of the economic status and household management of the home were made for the Newman schoolchildren by the School Nurse. Table IX shows that absence from school decreased as the home conditions improved.

TABLE IX
PERCENTAGE ATTENDANCE ACCORDING TO ECONOMIC STATUS AND HOUSEHOLD MANAGEMENT

Grade	Plus		Average		Minus	
	No.	Percentage Attendance	No.	Percentage Attendance	No.	Percentage Attendance
Economic Status ..	9	91	33	85	11	88
Household Management	11	92	24	88	18	85

The relations of economic status and household management to the physical development of the children in the "nutritional" group at the end of the study are shown in Table X. For simplicity the results are expressed as deviations from age norms.

Besides the generally low level of physique in the "nutritional" group, there were gradients in most characteristics according to economic conditions and household management, even within the narrow limits of home conditions found in the group. Berry and Cowin (1954) found that household management ratings, mothers' intelligence, and sleeping conditions, as well as dietary differences all affected children's physical measurements.

DISCUSSION

The attained measurements of the three groups remained very much the same in relation to age throughout the study. This indicates that, even when the Newman children were considered healthy enough to take their place within the ordinary schools, they had not attained the physique of the controls or, in fact, of normal average children. In addition to the nutritional differences there may, therefore, be some other differences, *e.g.* in the hereditary make-up of the groups which affected selection. When the weights and heights of the available parents of the children in the "nutritional" group were measured, they were found to be significantly shorter but not lighter than the national averages for the corresponding ages.

This somewhat slender evidence and the smaller-than-average size of the siblings (who were considered to be in normal health), suggests that there may be constitutional differences between the groups.

Even in respect of weight for height or weight according to skeletal measurements (which allow a lower standard) the children in the "nutritional" group had not quite reached normal. It may, therefore, be unjustifiable to expect these children to have the same gain in weight and height as the controls—who were not only bigger but often above average for age.

During the school holidays when the living conditions can be presumed to be similar, the growth of the "nutritional" group appeared to fall behind that of the "siblings". This suggests that the open air school was maintaining the "nutritional" group at a higher level than they would otherwise have reached. Follow-up results showed that after leaving the Newman School the children tended to regress.

It is also noteworthy that the Newman School

TABLE X
PHYSICAL CRITERIA ACCORDING TO ECONOMIC STATUS AND HOUSEHOLD MANAGEMENT (NUTRITIONAL GROUP ONLY) EXPRESSED AS DEVIATIONS ABOUT AGE STANDARDS

Grade		Household Management			Economic Status		
		Plus	Average	Minus	Plus	Average	Minus
No. of Children		21	12	22	8	32	15
Physical Criteria ..	Weight (kg.)	−5·8	− 8·1	− 6·4	−4·27	− 6·27	− 8·31
	Height (cm.)	−1·0	−15·6	− 5·6	5·0	− 4·0	− 5·3
	Weight minus Predicted Weight (kg.)	−0·55	− 1·18	− 1·00	0·09	− 2·05	− 3·09
	Body Fat (0·1 mm.) ..	−7·9	−17·3	−15·6	−5·0	−13·5	−16·3
	Weight Gain (kg.) ..	−0·41	− 0·36	− 0·27	0·32	− 1·32	− 2·18
	Height Gain (cm.) ..	+1·4	0·5	0·9	2·0	3·3	+ 2·1

regime was unable to remove differences associated with the poorer home conditions.

These findings suggest that further progress might be made by ensuring that the home conditions (especially of feeding and sleeping) are maintained at an adequate level.*

It might also be worth considering extending the accommodation to full residence at least for part of the year. The data certainly do not support any suggestion that the length of treatment could be reduced without adversely affecting its results. Practical considerations of demand for accommodation in the Newman School may even already require that some children may have to leave before the full benefit to their physique has been achieved.

Summary

(1) The investigation compares the physique and growth of debilitated children at an Open Air School with their brothers and sisters attending ordinary schools and with a control group of selected healthy children over a period of 3 years.

(2) Weights and heights, chest girth, body fat, acromial breadth, and "ideal" weights predicted from skeletal measurements were all found to be low in the "nutritional" debility and "sibling" groups compared with standards based on the physique of L.C.C. children or with means for age. Much of the nutritional group's inferiority in physique was of long standing.

(3) Growth during the period was also greater for the controls than for the other groups, although the girls in the "nutritional" group increased most in the last year. Height gains showed smaller differences.

(4) Growth during school holidays and after leaving the Newman School were especially low in the "nutritional" group.

(5) Home circumstances appeared to affect the progress of those at the Newman School, in spite of the better school conditions.

(6) Normal growth and physique were not reached by most of the Newman children even when they left the school, but they appeared to maintain a higher level than they would have reached without the special treatment.

We wish to express our thanks to Dr. E. R. Bransby of the Ministry of Health for initiating this study, and to all those who co-operated in carrying out the project; especially to the late Mr. W. Child, Headmaster of the Newman School, for his enthusiastic help throughout, and to the other head teachers, Miss B. Greenhalgh, Mr. J. H. Bagot and Mr. G. Naylor. We are also grateful to Nurse G. K. Cave of the Newman School, who made the home assessments, and who took, with Nurse N. Lloyd, the monthly measurements, and to Miss W. M. Cooper of the office staff for record keeping and clerical help.

*Attempts were made to see that the parents of the Newman children gave them the ordinary meals provided for the rest of the family and did not rely on the Newman School meals as being sufficient in themselves.

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